SCIENTIFIC AMERICAN

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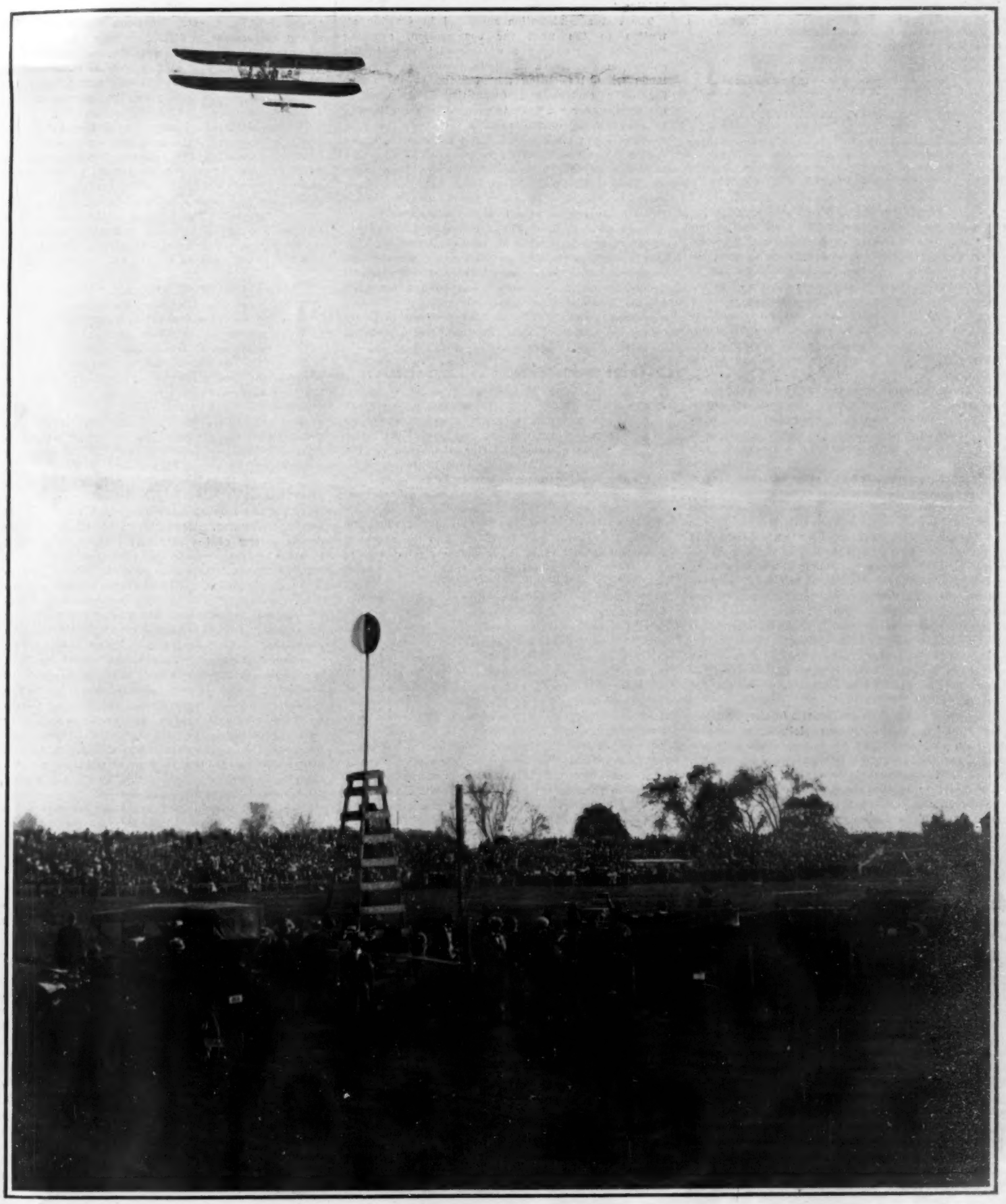

Photo. by Edwin Levick.

Johnstone in his Wright biplane at the Harvard meeting.

THE HARVARD INTERNATIONAL AVIATION MEETING.—[See page 216.]

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NEW YORK, SATURDAY, SEPTEMBER 17th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CONSERVATIVE CONSERVATION.

THE judicial quality in Mr. Taft has seldom shown to better effect than in his recent speech before the Conservation Congress at St. Paul, in which he not only gave a remarkably lucid statement of present conditions in the movement for conservation of our national resources, but suggested what must seem to all thoughtful readers of his address, to be a most admirable policy for conserving these resources without putting any arbitrary limitations upon their proper and lawful development.

The broad principle of conservation is essentially a sound one; but, like many other economic principles, it may be applied with such rigor and produce so many collateral evils, that the movement of which it is the basis may be productive of more harm than good.

It is a characteristic of the reformer that his enthusiasm appears too often to grow at the expense of his sense of proportion. So completely obsessed is he liable to become with his subject that it fills, for the time being, the whole horizon of his thought and energy—or is it that his angle of outlook is so narrow that he can see but one problem at a time, and so fails to judge of it in its necessary relation to contextual and related conditions? Whatever the explanation, it is a fact that reform legislation frequently runs to extremes, and is followed, after more mature deliberation, by laws designed either to rescind or greatly modify the over-hasty work of an earlier day. This is exactly what has occurred, or rather, is now taking place, in the movement for conservation.

True conservation does not consist in the wholesale withdrawal from public use or exploitation of natural resources, and preserving them untouched and unfruitful for the use of remote generations. As Mr. Taft said, "the problem is how to save and how to utilize, how to conserve and still develop; for no sane person can contend that it is for the common good that Nature's blessings be stored only for unborn generations."

It was this rather crude conception of conservation which governed the generally good work done by the last administration, and as a result of conservation measures enacted by Congress, not only was a vast amount of public domain withdrawn from public entry under a mistaken impression as to its economic character; but much of the land so withdrawn was locked up under such rigid restrictions as to entirely prevent its exploitation, even along lines which would have benefited the private owner and the general public alike. During the present administration, however, Mr. Taft, who declares himself an enthusiastic conservationist, saying, "As President of the United States, I have, as it were, inherited this policy, and I rejoice in my heritage," points out that real conservation is that which makes a wise and economical use of our natural resources in the present generation, and at the same time uses every possible means of preservation, consistently with this use, for the benefit of generations to come.

There has been altogether too much random speech and writing upon this subject, much of which has been prompted by personal or political motives, or has had its origin in the suspicion, rancors or jealousies which have been aroused against the so-called moneyed interests which are supposed to have been, and in many cases indeed have been, the worst offenders. The time has come, however, to look at this most important question with a judicial mind and carefully consider, before making withdrawal of public lands, the effects of such withdrawal upon the present and ultimate welfare of the individual, the State, and the nation. Says Mr. Taft: "I beg of you, therefore, in your deliberations and in your informal discussions, when men come forward to suggest evils that the promotion of conservation is to remedy, that you invite them to point out the specific evils and the specific remedies; that you invite them to come down to details in order that their discussions may flow into channels that shall be useful rather than into periods that shall be eloquent and entertaining, without shedding real light on the subject. The people should be shown exactly what is needed in order that they may make their representatives in Congress and the State legislature do their intelligent bidding."

The last administration succeeded in drawing attention to the need for conservation, arousing throughout the country a widespread interest in the subject, and effected a wholesale withdrawal of public lands without adopting any well-thought out policy for their control and disposition. The present Congress, under Mr. Taft, is engaged in a readjusting or re-classifying of the lands so withdrawn, and in working out a practicable method for their sale and control. The President is firm in his belief that title to the lands that have been withdrawn from entry should be retained permanently by the public; and except in the case of water power sites, he would have the title retained not by the State, but by the national government. The practice of leasing coal fields, to be operated by private capital, which has been worked out to such good effect in Australia and New Zealand, is largely the basis for the President's belief that capital will stand ready to interest itself in coal, phosphate, iron, and oil lands on the basis of a lease similar to those under which privately owned properties of this character are now being operated.

GRADE CROSSINGS SHOULD BE AUTOMATICALLY GUARDED.

THE frequency with which automobile wrecks are occurring at grade crossings shows no signs of diminishing; and one of the latest of these disasters, which happened on the Long Island Railroad, was due to a cause which is, to say the least, extremely disconcerting. In the first place, the existence of such a thing as a grade crossing within the thickly-settled suburbs of New York city is an invitation to disaster, no matter what precautional measures may be taken; and the shocking death roll at such crossings is sufficient proof, surely, that every one of them should have been abolished long ago. It is not sufficient to say that the work of elimination of these death traps is being steadily done—it should be at once hastened to completion. However, it seems certain that crossings of railway tracks by highways, at grade, will be with us for many years to come, especially in the outlying districts; and the question arises whether means cannot be taken to mitigate their danger, and prevent at least some of the annual tragic loss of life. The ordinary precautions are to provide at the crossing an electric bell, a set of gates, and a watchman. In the case of the accident referred to, the watchman was at his post; but through misunderstanding, or some other equally fatal cause, he lifted the gates and permitted an automobile to pass on to the tracks just as a train was speeding by. Obviously, accidents of this kind, which may be set down to the fallibility of the human element, might be prevented by so arranging the gates that they will be raised or lowered by mechanical power, operated, through electrical or other suitable connections, by the train itself as it approaches a crossing. With the gates properly balanced, no large amount of power would be necessary for their operation; certainly not more than is now successfully used in switch and signal work. An electric contact point a few thousand feet up track from the crossing, and the installation of some form of electric motor at the gates, supplemented by a warning bell and a watchman, would render impossible a repetition of such horrible tragedies as this on Long Island, in which five occupants of the car were killed.

THE SECOND CITY OF THE WORLD.

IF London is destined to remain for many decades to come the first city of the world in point of population, the census figures prove that New York will remain an easy second, with a population which at present is nearly twice as large as that of Paris, which ranks in the third position. Furthermore, if London and New York maintain the respective rates of growth of the past ten years, it is certain that before many decades have passed, the most populous city in the world will be found on this side of the Atlantic. The population of New York in 1900 was 3,437,202. On September 1st, 1910, it was announced by the Census Bureau that this city contained 4,766,883 persons. The increase during the ten years was 1,329,681, which represents a gain of 38.7 per cent—a truly extraordinary rate of increase for so large a city.

Those of us, however, who are familiar with the history of New York will remember that this city has ever been distinguished for its rapidity of growth; for it is a fact that, in the hundred and twenty years which have elapsed since 1790, there have been but four decades in which the percentage of gain has not greatly exceeded that of this last decade. In the decade ending 1820, the rate was 28.4; in 1870, the disturbance of the war showed itself in the low rate of 15.8, though it rose in the next decade to 28, and in the decade ending 1890 to 25.6 per cent. The largest rate of growth was that of the ten years succeeding the war of the Revolution, when the population increased from 33,171 in 1790 to 60,515 in 1800, an increase of 82.7 per cent. Ten years later the city had shown an increase to 96,372, equivalent to a gain of 59.3 per cent. In 1830, the rate stood at 63.8; in 1840, at 54.4; in 1850, 64.9, and in 1860 at 57.8 per cent. The city first exceeded the million mark in the decade ending 1880, in which year the population was 1,206,299.

The population of London in 1901 was 6,581,372, and it is estimated that the present population is over 7,500,000. Paris, in 1901, possessed a population of 2,714,068; which has probably grown to considerably above 3,000,000. In 1906, Berlin contained 2,040,148 people, and two years ago Tokio, Japan, had a population of 2,085,160. Ten years ago, the population of Chicago was 1,698,575, and it is possible that the increase during the interval has served to make that city the fourth ranking city in size in the world.

ADVANTAGES OF OIL FUEL FOR NAVAL SHIPS.

THE fact that the United States navy has begun to purchase fuel oil by contract and is preparing to establish storage depots from which naval vessels may regularly fill their tanks, proves how thoroughly satisfied the authorities are with the careful tests which they have been making for many years past. As compared with coal, fuel oil shows the following advantages: It possesses a greater evaporative efficiency over coal of about 14 to 9, and its use not only gets rid of the problem of dirty and clinkered fires, and the always troublesome disposal of the ashes, but renders possible a great reduction in the fire-room force. It avoids the great labor and inconvenience attending the coaling of ships, the manual labor for which work is practically eliminated. The oil can be piped into the double bottom of the ship and utilized in compartments which at present serve no useful purpose. In proportion as a large supply of oil is carried, and the coal supply reduced, the considerable amount of space now occupied by coal bunkers is rendered available for other purposes. With the use of oil fuel, it becomes possible to make sudden variations in the power developed by the boilers and to change rapidly from cruising to full-power speed. The control of combustion is practically absolute, it being possible with oil fuel to admit exactly the desired proportions of air for the best results. Firing with oil fuel insures a longer life to the boiler, and particularly does it reduce repairs on the tube-sheets; for there is no necessity for the opening and shutting of furnace doors, with its resulting sudden variations of temperature in the firebox.

Considered from the standpoint of the strategist, oil fuel is of inestimable advantage, for it becomes possible, except when the boilers are being very hard pushed, to eliminate smoke and so get rid of one of the most tell-tale evidences of the location of a fleet.

An improved producer for use in obtaining gas from lignite has been brought out on the Continent. It is observed that lignite will not give a gas of a high calorific power unless it is distilled below 500 deg. C. (932 deg. F.). At a higher heat the result is not good, as the carbides are decomposed. The apparatus consists of an inclined gas retort placed at 40 degrees angle and the lignite to be distilled is fed down slowly from the top. Connected with the lower end of the retort is a set of piping from a coke producer and the gases from the producer enter directly into the retort. The working of the producer is regulated so that the gases come out at a temperature which does not rise above 500 deg. C., and the lignite is thus heated by these gases and distilled at the standard temperature. The lignite is given a previous heating by hot gases before entering the retort. After leaving the apparatus at the top the gases from the lignite pass into a rotary scrubber. The coke is removed from the bottom of the retort and it falls into a water tank from which it is taken in the form of hard and compact pieces of a very good quality. Such coke is used to feed the producer which we have just mentioned. Lignite gas can be applied to many uses, such as gas motors or for gas furnaces for melting metals or glass.

ENGINEERING.

Despite its present enormous proportions, the great Krupp plant in Germany grows apace, the number of employees having increased 5,000 in the last few years, bringing the present force up to 68,500 men. The total steam power in the plant amounts to 89,430 horse-power, and a total of 2,690 electric motors has an aggregate output of 50,491 horse-power.

There is being constructed at Dumbarton, Scotland, a 54-foot motor yacht, which will excite much interest because of the novelty of its motive power. The yacht will be provided with a suction gas plant, and a high-speed suction gas engine direct connected to an electric motor. It has been proposed to arrange the propeller shaft so that it may be coupled either to the electric motor or direct to the suction gas engine, an arrangement which would allow the efficiency of the motor to be determined with great accuracy.

The expense and trouble occasioned by broken water being driven above the parapet of the sea wall at the naval station at Key West and washing out the earth fill back of the wall, led a civil engineer, DeWitt C. Webb, of the Civil Engineer Corps, to construct along the outer edge of the crest of the wall an outwardly-curving, concrete coping. The effect of this device has been to fling the broken water, that rushes to the seaward face, outwardly toward the sea, effectually preventing the washing out of the earth backing.

In connection with the annual meeting of the National Association of Cement Users, a cement show is to be held in New York, December 17th to 23rd, 1910. A similar exhibition will be held in the Coliseum, Chicago, February 17th to 23rd, 1911. In view of the great strides which have been made in the cement industry, particularly in the field of reinforced concrete, these exhibitions should excite a wide interest; and if the exhibits represent careful and intelligent selection, both enterprises will have a high educational value.

After listening to a recent address given in this city on the subject of the operation of submarines, a well-known aeronaut expressed the opinion that the use of the spirit level to determine the degree of deviation of the axis of a submarine from the horizontal contained a suggestion which might prove to be of practical value to the airman. He considered that a graduated level might be attached, where it would be within easy vision of the operator, and serve to show him when his machine was at the proper inclination for the particular speed at which he was traveling.

In view of the fact that since 1902 the interlocking functions on the Pennsylvania lines east of Pittsburg have increased from 7,891 to over 20,000, the company has instituted a new plan of training men to maintain and operate its signals. Four signal apprentices, graduates of technical colleges and schools, have recently been appointed. The signal apprentices, after serving a three years' course, will have open to them the position of Signal Inspector in the Signal Engineer's office, after which they will be in line of appointment through four superior grades to that of Signal Engineer.

The new French dreadnoughts, "Jean Bart" and "Courbet," which are now being laid down, will be 541½ feet long, 88 feet broad, and on a mean draft of 29 feet will displace 23,467 metric tons. Eight 12-inch guns will fire dead ahead and dead astern, and ten on either broadside. It is claimed that improved operating mechanism in the barbettes and turrets will permit a rapidity of fire from each gun of a round in 25 seconds, although we doubt the practicability of this. The secondary armament of twenty-two 5-inch guns will be protected by 7 inches of armor.

A fact of particular interest which developed at the second International Road Congress, held this year at Brussels, was the great extent to which stone block pavements are used in Europe on country roads. In Belgium one can travel from Antwerp to Brussels over a continuous stone block pavement, which has been laid not merely in the suburbs, but through country districts that are devoted entirely to agriculture. The time is coming when the construction of permanent roads will be regarded as indispensable for the full development of agricultural districts; and where the cost of material is not prohibitive, stone block pavement is certain to receive careful consideration.

Amid all the work which has been done and proposed in furnishing better transit facilities for Greater New York, Staten Island seems to have been completely neglected. There is some prospect, however, of the island being afforded rapid transit connection with the main line through the efforts of private capital. A company has been formed to build a tunnel beneath the Narrows, which it is proposed to construct approximately upon the plans which were first followed on the subway crossing below the Harlem River, and were later developed and applied in the great Detroit Railway tunnel of the New York Central system. These consist in driving lines of pile supports and constructing a steel and concrete tunnel upon the foundation thus prepared.

AERONAUTICS.

Breguet carried up five passengers, besides himself, at Lille on August 29th, in an aeroplane of his own invention. The total load weighed 922 pounds.

It was recently announced that Murray Simmons, a junior officer of the White Star Line steamer "Oceanic," will be the navigator of the Walter Wellman airship on its projected voyage across the Atlantic.

With $50,000 in cash prizes and the opportunity of sharing all the profits of the undertaking after the necessary expenses are deducted, it is expected that at least $200,000 will be divided among the aviators who will take part in the International Aviation Tournament at Belmont Park.

The experiments which Horton and McCurdy are making at Hammondsport, N. Y., for the purpose of ascertaining the possibility of aeroplanes for transmitting and receiving wireless messages have attracted the attention of the United States Signal Corps. Lieut. Clarence C. Culver has been assigned to watch the experiments and report upon them.

The French Ministry of War has ordered ten military monoplanes and twenty biplanes for delivery within the next three months. This will give the French army an aerial flotilla of sixty by the end of the year. Some aeroplanes are also required for 1911. These must be able to carry a weight of 661 pounds in a flight of 186 miles at a minimum speed of 37 miles an hour. A premium of $20,000 for a machine fulfilling these conditions is offered.

John B. Moissant after many mishaps completed his flight from Paris to London on September 6th, exactly three weeks after he started. The few miles that still remained to be covered were made in two stages largely because adverse winds were encountered which forced a descent. His machine was seriously damaged in landing. The London Daily Mail is to give a cup valued at $250 to Mr. Moissant in commemoration of his flight.

At noon on September 3rd, M. Bielovucci arrived at Bordeaux, completing the final stage of his flight from Paris to Bordeaux, which he made with but four stops. His time from Paris to Bordeaux was 7 hours, 5 minutes and 54 seconds of actual flying, and the route covered is estimated at about 366 miles. On the last leg he maintained an average speed per hour of 54 miles. Head winds frequently hampered him. At one time he was forced to ascend to a height of 300 feet before he could cross the Dordogne River.

Weymann recently attempted to win the special Michelin prize of $20,000, offered for the first aviator who, with a passenger, glides in six hours from Paris to the top of Puy-de-Dome, after circling the steeple of the cathedral at Clermont-Ferrand. The Puy-de-Dome is a mountain 4,800 feet high. The distance to be covered is 217 miles as the bird flies. Weymann, in a Farman biplane, ascended at Buc at 11:45 A. M. on September 7th, and at 11:58 crossed the starting line above St. Cloud. After passing Mont Lucon, he ran into a fog and blinding rain, and although he reached a point within thirteen miles of his goal, he lost his bearings at 5:30, and was obliged to descend on account of darkness.

Many aeronauts assert that to them the surface of the earth, viewed from a balloon, appears concave. Various hypotheses have been advanced in explanation of this optical illusion. According to one theory the curvature of the retina produces the illusion of concavity, both in the earth's surface seen from above and in the sky viewed from below. The German engineer Heinel suggests a hypothesis which is independent of the physiology of vision and is based on the purely physical laws of refraction. Heinel explains the illusion by the variation of the refractive index of the atmosphere as a function of density and, consequently, of altitude. According to Heinel's calculations, the surface of the earth, supposed plane, would present, to the eye of an observer in a balloon at an elevation h, the form of a spheroid, having its axis of revolution vertical and its center at the eye. The length of the vertical semi-axis, or the apparent distance of the point of the earth's surface which is directly beneath the eye, is $0.4558h$. (In other words, the ground, like the bottom of a pool of water, is brought nearer to the eye by refraction.) For the horizontal semi-axis of the spheroid Heinel gives the formula $\frac{0.3849h}{\sqrt{N_0 - n}}$, in which N_0 and n are the absolute indices of refraction of the air at the earth's surface and at the altitude of the observer, respectively. This value is enormously greater than that of the vertical semi-axis. Hence the spheroid is very oblate and the apparent concavity of the ground is very slight, but the formula shows that the concavity increases with the difference between the two indices of refraction. In reality the level surface of the earth is not plane, but has a concavity which would theoretically diminish the apparent concavity caused by refraction, but the curvature of the area which is visible from a balloon is so small that it need not be taken into account.

SCIENCE.

Before the British Association at Sheffield, Drs. Russell and Chittenden read a paper in which they remarked that they had discovered micro-organisms which poison the nitrifying bacteria essential to the fertility of the soil. We hope to publish in the SUPPLEMENT of the SCIENTIFIC AMERICAN the text of the paper.

The Zeitschrift fuer angewandte Chemie states that 2179 chemists and 224 chemical technicians were employed in German industrial establishments in the year 1908. The corresponding numbers for the preceding year were 2099 and 209. The employment of so large a number of chemists explains the flourishing condition of chemical manufactures and industries in Germany.

The National Bank of Spokane, Washington, has received the first consignment of washed bank notes. The United States Treasury is still experimenting with devices intended to launder dirty banknotes before restoring them to circulation. The $50,000 in bills which has been distributed by the Spokane National Bank have been signed with ink consisting largely of carbolic acid.

Most gourmets like cheese which is literally swarming with maggots. These are usually bred from eggs deposited in the cheese by a fly called Piophila. G. Alessandrini, an Italian biologist, has recently been studying these larvæ. He found that when they are fed to dogs, they pass through the alimentary canal without affecting the animal. The canal, however, may be scratched by their oral hooks. They seem hard to kill, too, for Alessandrini found that some lived for sixteen hours in 70 per cent alcohol, and others for thirty hours in petroleum.

In a recent number of the Annals of Surgery, Dr. Alexis Carrel, of the Royal Institute, not only suggests the probability of intra-cardiac surgery, but even points out the technique of the various procedures which he believes will be developed in its performance. The real difficulty lies in the maintenance of the circulation, especially of the blood supply of the brain, during the slow and delicate operations. Dr. Carrel, however, has suggested a means of central and lateral diversion to overcome the difficulty. Dr. Carrel insists that none of the procedures he recommends has as yet attained the technical perfection which warrants application to the human being.

Barnard concludes from his personal observation of cobras in Ceylon that the serpent's traditional love for music is a pure fable, and that the only effect of music is to arouse the reptile's curiosity, which is excited by any loud and acute sound. The cobra protrudes its head from its burrow alike on hearing the snake charmer's flute, the rattling of a chain or the sounds made by beating the ground with a switch. It appears to perceive only sounds of high pitch, for it pays no attention to the low notes of the flute or the beating of a drum. Barnard also confirmed, in Ceylon, the results of observations made in the London zoological garden on the supposed power of fascination exerted by serpents upon birds, and he concludes that this power of fascination is also purely imaginary.

Cole has found that the sense of hearing in the shrimp (*Gammarus vulex*) is very rudimentary and is confined to a remarkably small portion of the musical scale. In Cole's experiments the sounds were usually produced by a tenor trombone. When a loud note of the proper pitch was sounded some shrimps responded in a striking manner by folding the first pair of antennæ tightly beneath the body. This effect, however, was produced almost exclusively by the note C sharp of the middle octave, so that the shrimp offers the remarkable example of an animal whose sense of hearing is almost restricted to a single note. Moreover, only a few of the shrimps tested responded even to this note and these few soon became fatigued and ceased to respond.

The processes currently employed for making milk powder are based upon desiccation by heat. In a process recently devised in France by Lecomte and Lainville the action of cold is substituted for that of heat. The milk is poured into vessels similar to those which are used for producing blocks of artificial ice, and is cooled to a few degrees below the freezing point (about 28.5 deg. F.). Suitable precautions are taken to prevent the water of the milk from freezing in a solid mass and to cause it to assume the form of fine snow. The congealed milk is then placed in a centrifugal separator which revolves very rapidly. The snow crystals remain in the machine while the other parts of the milk are expelled in the form of a soft, greasy paste, which still contains some water. The desiccation is completed by placing the paste in a drying room heated to a moderate and uniform temperature. The milk powder thus produced has been proved by analysis to contain all of the constituents of the milk, except the water, in an unaltered condition. The process is equally applicable to whole milk, and to milk deprived of part or all of its cream.

FOUCAULT'S PENDULUM ELECTRICALLY PROPELLED

BY DR. CHARLES FORBES, COLUMBIA UNIVERSITY

In the SCIENTIFIC AMERICAN of February 8th, 1908, was described Foucault's pendulum experiment demonstrating the earth's axial rotation. The experiment was arranged and performed by Dr. Forbes in St. Paul's Chapel at Columbia University. On account of the gradual dying out of the pendulum vibrations, the demonstration lasted for only about one hour. More recently he has devised an electrical device by which the pendulum may be kept vibrating any desired length of time. The apparatus is installed in a special elevator shaft at Barnard College, Columbia University. Fig. 1 is a photographic reproduction of the pendulum ball and accessory apparatus as seen from one of the physical laboratories through a large plate glass window. The shaft being inclosed, there are no air currents to disturb the pendulum vibrations. The ball is of lead, 7 inches in diameter, and its weight is 80 pounds. It is supported by a brass wire 1/8 inch in diameter and 70 feet in length. Through the ball there passes vertically a soft iron rod 1 inch in diameter, which has at its lower end a disk-shaped mass of cast iron. The details are represented in the vertical section, Fig. 2. Beneath the ball is located an electro-magnet, and its relative size and position are also represented in Fig. 2. On the magnet there are 2,000 turns of magnet wire. The energizing current is of about 12 volts and 1 ampere. Any convenient source of direct-current electricity may be used. The suspending wire is attached at the top in the same way as described in the SCIENTIFIC AMERICAN of the issue noted above.

In performing the experiment, the ball is drawn to one side in the usual way by a string looped to the hook in the side of the ball and attached at the other end to some rigid support. The ball is allowed to remain secured in this way until all lateral vibrations have ceased, when it is released by burning the string. Gravity is aided by the attraction of the electro-magnet in causing the pendulum to swing. It is evident, however, that the magnetic attraction must only take place when the ball is approaching the magnet. The current is to be interrupted when the pendulum has reached the center of oscillation. This is accomplished as follows, through the action of a reversed relay (Fig. 3) which requires a current of about one ampere and six volts. If the ordinary relay is used, its platinum contacts should be reversed so that when it is idle the electro-magnet current will act upon the magnet and when in action the magnet current will be interrupted. The relay current is controlled in its action by the automatic interruptor located about one foot below the upper end of the pendulum wire. Its details are represented in Fig. 4. It will be observed that the wire passes through an adjustable platinum covered conical sleeve, surrounded by an annular disk having sliding contact with a larger insulated supporting annular disk, with an attached electric wire extending down to and through the relay magnet, and relay source of electric current up to the upper end of the supporting pendulum wire. In this experiment a special reversed relay is being used. An inspection of Fig. 3 will reveal its construction. The binding posts on the left receive the relay current and those on the right the electro-magnet. If the latter is of high voltage the relay contacts may be lowered into the vessel of oil resting on the shelf below, thereby preventing the arcing of the current at the time of the interruption. As illustrated, the electro-magnet current is represented closed. The interruption takes place when the armature of the relay is attracted. This interruption is brought about by the vibration of the pendulum in the following manner: As already stated, the pendulum is attracted during its vibration until it is over the electro-magnet, when the attraction ceases due to the fact that the sleeve at the upper end of the wire, Fig. 4, comes in contact with the platinum lined annular disk, when immediately the relay circuit is closed, thereby interrupting the magnetic circuit. This condition continues while the pendulum is completing its oscillation away from the magnet. On the return of the pendulum the relay circuit is broken and the magnetic circuit is again closed. The advantage of the conical sleeve is that adjustments may be made so that its operations may take place at just the time the pendulum reaches the center of its oscillation. It will be observed that since the apparatus is symmetrical, the pendulum will vibrate equally well in all directions.

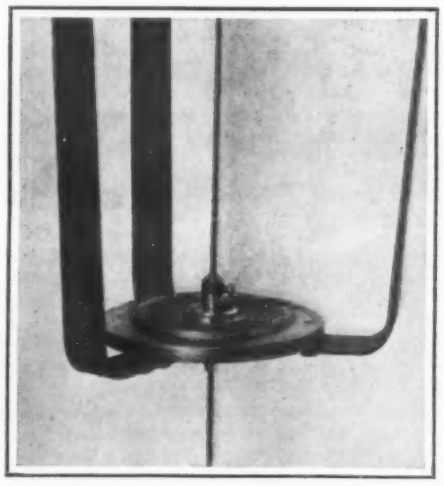


Fig. 4.—Automatic interrupter which controls the action of the relay current.

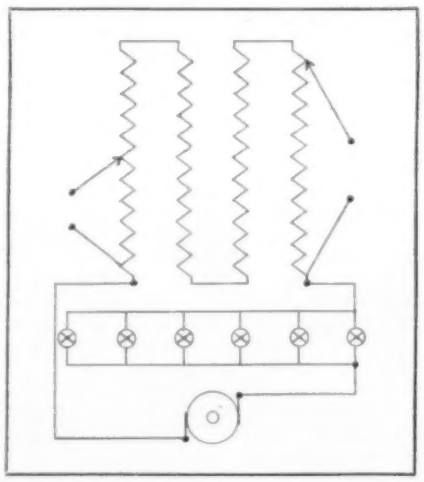


Fig. 5.—Diagram showing the arrangement of apparatus for obtaining the magnet and relay currents.

In this experiment, as illustrated in Fig. 1, the direct electric light current of 110 volts is used. The arrangement of the apparatus for obtaining both the magnet and relay currents is illustrated in Fig. 5. The dynamo circuit is represented passing to six 16-candle-power lamps in parallel, which serve as a variable resistance and also to light up the shaft in which the experiment is being performed. Connected with the lamps, in series, is a resistance coil of about 12 ohms. Through the coil, the dynamo circuit is completed. From the coil, the two currents of the desired voltage are obtained. In each case the voltage may be varied by shifting the contacts indicated by the arrow points. The principle of the working of the apparatus is that of the potentiometer. For the continued working of the experiment the electric light current is proving to be most satisfactory. The pendulum deviations, due to the earth's axial rotations, are recorded on the graduated arcs seen in Fig. 1. The diameter of the circle is 39 inches. The record is made by a brush located at the bottom of the pendulum ball which sweeps through a little pool of ink held in a shallow depression in the upper surface of the cast iron top of the electro-magnet. The details are clearly indicated in Fig. 2.

While Foucault's experiment has been successfully performed a number of times, particularly in St. Paul's Chapel, this is the first time, so far as we know, that the pendulum has been kept swinging through the agency of electricity.

The apparatus is permanently located in Barnard College; and at convenient times, the experiment will be repeated at Columbia University for visitors who may be interested in seeing it.

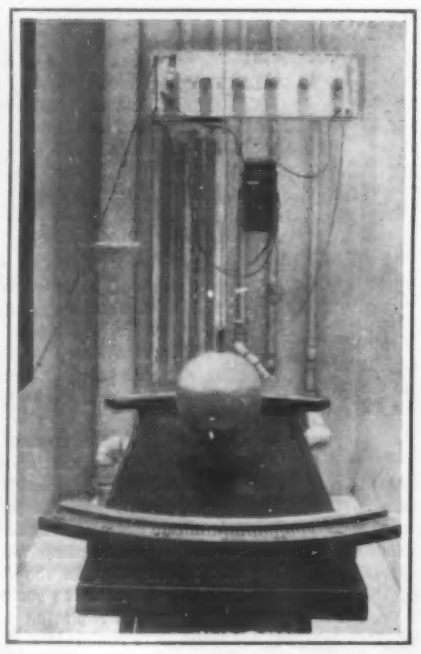


Fig. 1.—View of pendulum ball and accessory apparatus used in demonstrating earth's axial rotation. The shaft is inclosed so that air currents cannot disturb the pendulum vibrations.

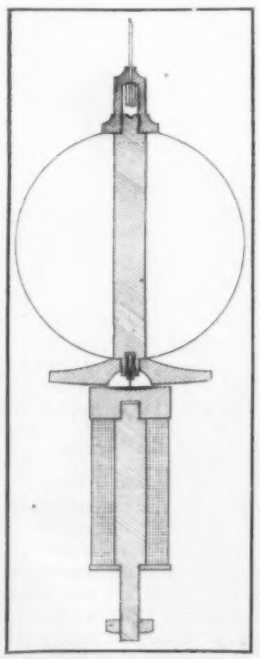


Fig. 2.—Vertical section showing shaft through the ball from which a pointed brush dips into ink-pool at top of electro-magnet.

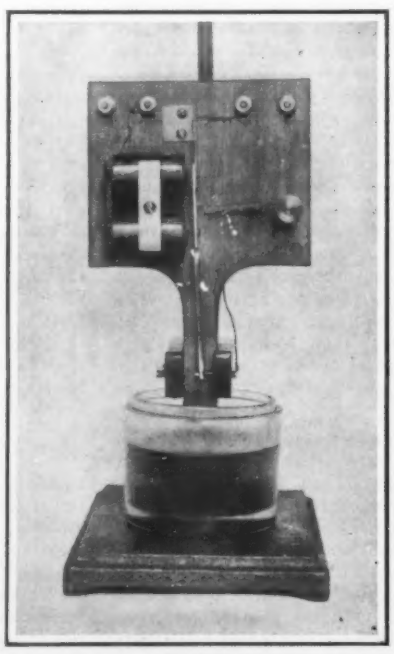


Fig. 3.—Reversed relay which interrupts current when pendulum has reached center of oscillation. A current of one ampere and six volts is required.

FOUCAULT'S PENDULUM ELECTRICALLY PROPELLED.

Game Farming.

BY JOHN L. COWAN.

Among the numerous expedients proposed to bring about a reduction in the cost of living, not the least striking is game farming, which has been earnestly advocated by the Hon. James Wilson, Secretary of Agriculture, and which is dwelt upon at some length in publications of the Division of Biological Survey. A proposition to attempt the introduction of the hippopotamus and other African game animals has received some attention; but it would appear that the breeding of native American game animals is a more rational undertaking.

There never was a more useful game animal than the American bison, of which it is estimated that at least 4,000,000 roamed the plains within the memory of men who are still living. At one time the species was so nearly exterminated, that it is believed there were not one hundred left alive. Of late years they have been reared in considerable numbers, not only for park purposes, but notably on the famous "101 Ranch," owned by the Miller brothers in Oklahoma; on the Goodnight ranch, in Texas; on the Flathead Indian reservation of Montana; and on numerous other Western ranches, and in game preserves scattered all over the country. Their rate of increase is about the same as that of beef cattle, and it has been conclusively proven that the cost of rearing buffalo per head is no greater than the cost of raising cattle.

(*Continued on page 224.*)

HOW THE GOVERNMENT FIGHTS FOREST FIRES

BY CHARLES A. SIDMAN

The recent devastation by fire of our forests in the West, with great destruction of property and life, have brought forth the query as to what the government is doing to prevent such wholesale loss.

It is not generally known that this government, under the jurisdiction of the Forest Service of the Department of Agriculture, has complete charge of all National Forests in the United States. It has a force of rangers and guards whose sole duty is to range the forests, keeping on the lookout for fires and to prevent timber thieves from cutting out valuable lumber.

The recent fires, which have so devastated certain sections of the Far West, have been outside of the National Forests, but have greatly endangered them. The lumber companies who own vast tracts of timber land in the vicinity of the recent fires have formed co-operative associations for fire protection, and employ a regular force of rangers for patrol duty during the fire season.

While in some sections of the country forest fires have always been of such common occurrence that there is a popular notion that they cannot be prevented, and while the risk from fires can never be entirely eliminated, for in the forest there is always inflammable material which is very easily ignited, they may, however, be largely prevented. Under efficient organization their damage may be kept down to a very small amount, and the problem is like that in cities, where fires can never be entirely eliminated, but where the risk of loss to property may be reduced to almost insignificance.

Ranger on patrol duty. Squaw Peak lookout station, Cabinet National Forest, Montana.

The causes of fires may be grouped under several heads—sparks from locomotives in transit, sparks from sawmills, donkey engines, etc., camp fires, clearing land and burning brush, careless smokers, incendiarism, and by lightning.

Of course, a careful supervision or patrol during the dry season is one of the most important measures in organized forest protection. The purpose of this supervision is to prevent fires from starting, to detect fires as soon as possible after they start, and to fight them. The fundamental principle under which the rangers work is to detect and attack fires in their incipiency. In an unwatched forest a fire may burn for a long time and gain great headway before it is discovered.

In the National Forests fire warnings are posted in a great many places. These warnings are printed in English, Italian, French, and Spanish. Those notices printed in Italian are posted where Italians are employed in railroad construction. The Spanish notices are used in New Mexico, southern Arizona, or wherever there are many Spanish-speaking people. Undoubtedly many forest fires have been prevented by these warnings.

Many ways are used to notify others of a fire, and in this respect there may be mentioned the use of lookout towers, telephones, signaling by means of fires, smoke signals as used by the Indians, the heliograph, flags, bells, whistles, and by means of a shining windmill.

The Forest Service has in use at the present time on its preserves more than 4,800 miles of telephone line for the purpose of calling help in time of fire.

The methods of fighting forest fires are essentially the same as those recognized in city fires—quick arrival at the fire, an adequate force, proper equipment, and a thorough organization of the fighting crew.

In the prevention of forest fires spreading, a fire line is used as an aid. Broadly speaking, this may be a road, a trail, a river, a line cleared especially for a fire break, or it may be a plowed furrow The purpose of this fire line is to check or stop them and to

(*Continued on page 225.*)

Fighting fire with sprinkler on the Wichita National Forest, Oklahoma.

Going to the head of a prairie fire in the Wichita National Forest.

Ground burned over within two hours, showing the cleared, blackened surface and how two freshly turned furrows completely checked the progress of the fire. (Marion County, Florida, five miles north of Ocala.)

Fire line in the Adirondack preserve, Franklin County, N. Y. A fire line may be a road, a trail, a river, a line cleared especially for a fire break, or it may be a plowed furrow.

HOW THE GOVERNMENT FIGHTS FOREST FIRES.

RULES GOVERNING THE COMPETITION FOR THE $15,000 FLYING MACHINE PRIZE OFFERED BY MR. EDWIN GOULD.

1. A prize of $15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

CONDITIONS OF ENTRY.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the GOULD-SCIENTIFIC AMERICAN Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horse-power, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the SCIENTIFIC AMERICAN on or before June 1st, 1911. Contests will take place July 4th, 1911, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the questions of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type whatever—aeroplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st, 1911.

Official Meteorological Summary, New York, N. Y., August, 1910.

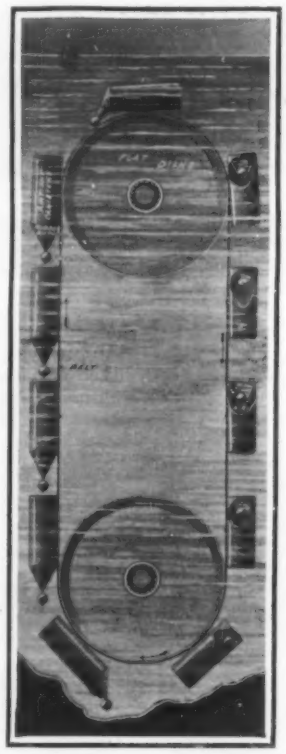
Atmospheric pressure: Highest, 30.33; lowest, 29.64; mean, 30.06. Temperature: highest, 85; date, 25th; lowest, 57; date, 27th; mean of warmest day, 77.5; date, 25th; coolest day, 65; date, 27th; mean of maximum for the month, 78.8; mean of minimum, 65.5; absolute mean, 72.2; normal, 72.2; average daily excess compared with mean of 40 years, 0.0. Warmest mean temperature of August, 77, in 1900; coldest mean, 69, in 1903. Absolute maximum and minimum of August for 40 years, 96 and 51. Average daily excess since January 1st, 2.6. Precipitation: 2.13; greatest in 24 hours, 0.80; date, 8th and 9th; average for August for 40 years, 4.53. Accumulated deficiency since January 1st, 6.25. Greatest precipitation, 10.42, in 1875; least, 1.18, in 1886. Wind: Prevailing direction, south; total movement, 6,659 miles; average hourly velocity, 9 miles; maximum velocity, 28 miles an hour. Weather: Clear days, 7; partly cloudy, 11; cloudy, 13; on which 0.01 or more of precipitation occurred, 12. Relative humidity, mean of 8 A. M. and 8 P. M., 72. Thunder storms, 2nd, 3rd, 4th. Heat and moisture summary of the summer: Average temperature, 72.67; normal, 71.40. Average precipitation, 7.46; normal, 12.33. Average humidity, 67.87. Number of days temperature reached 90 or over, 10.

A PERPETUAL MOTION MACHINE PROBLEM.

The perpetual motion machine is ever with us, and this in spite of the fact that the fallacy underlying all such mechanisms has been made clear times without number. In the majority of such devices, the cause or causes which render them inoperative are readily detected; in others, they are more obscure, and some ingenuity is needed to discover where the fallacy lies, and to make what is perfectly clear to one's self equally evident to other people.

We have been favored by Mr. Richard P. Horton, of Charlestown, Mass., with a sketch of a so-called perpetual motion machine, which he suggests we should publish for discussion by our readers, asking them to explain just why the device would not be operative.

As will be seen from the drawing, the machine consists of an endless belt, to which are affixed a number of empty vessels, one end of each of which is closed by an air-tight, flexible, conical cover. At the apex of each cover is a weight which, when the vessel is inverted, is sufficiently heavy to compress



FIND THE FALLACY IN THIS PERPETUAL MOTION MACHINE.

the air within the vessel and assume the position shown on the right-hand side of the belt. The belt runs on two disk pulleys carried on ball bearings and the whole is immersed in a tank of water. Along one edge of the belt is arranged a small endless rubber tube, which connects with the interior of each vessel, and permits a free circulation of the air between the vessels, as their diaphragms alternately change from the collapsed to the distended condition.

At the first blush, it might be thought that because of the greater buoyancy of the vessels on the left-hand side there must be some tendency for the belt and its attached vessels to travel around the pulleys, the latter rotating in the direction of the hands of a clock.

As a matter of fact, the device would not operate. But why?

We take much pleasure in following Mr. Horton's suggestion, and herewith present the device for discussion. The best of the replies sent in will be published in later issues.

Walter Wellman's airship, with which he hopes to cross the Atlantic Ocean, is about completed. The airship is housed in a building nearly 300 feet long by 75 feet high, erected by the enterprise of Atlantic City hotel keepers. The airship itself is about 220 feet long, and is the same craft with which Wellman unsuccessfully attempted to reach the Pole from Spitzbergen.

Insurance Against Rain.

The daily papers recently referred briefly to a report from the American consul-general in London on a form of insurance that was said to be becoming common in England, viz., insuring people who are going on a holiday against the occurrence of wet weather. It was stated that underwriters will insure against one-tenth of an inch of rain falling on more than two days in a week in any towns on the east and south coasts of England. Upon the payment of a small sum a policy is issued for ten days, under which it is agreed to pay the person insured at the rate of $2.43 a day in excess of two wet days. If higher compensation is desired, a higher premium is charged.

The scope of wet weather insurance is, however, much wider than would be inferred from the above-mentioned newspaper paragraph, and is fully set forth in an article by H. J. Gooding in the current number of Symons's Meteorological Magazine. Wet weather frequently results in financial loss to the promoters of agricultural, horse, or flower shows, fêtes, athletic meetings, pageants, fireworks, etc., and all these are now commonly insured against it at Lloyd's. The premium for an insurance against a rainfall of one-tenth of an inch during a day of twelve hours or less in the summer months, June to September, has been fixed at 20 to 25 per cent, according to the part of the country involved. This is for the simple risk of rainfall, which in point of fact, however, is seldom asked for, the common form being an indemnity against loss through rainfall, viz., against the receipts for admission falling short of the expenses of the venture in consequence of rain. A higher premium is charged for the latter form of policy, as it involves a second consideration—the attractiveness of the meeting and its power to draw gate money in spite of wet weather. It is usual to stipulate that the premium must be paid three days before the day insured; so that the policy holder can hardly be aided in deciding whether insurance is advisable by the announcements of the "clerk of the weather" or his own weather wisdom.

New High-Flying Records.

Leon Morane broke his own world's record of 7,054 feet for height by ascending to a height of 8,472 feet at Deauville, France, on September 3rd. The feat was in every way one of the most daring and hazardous ever attempted. When over a mile and a half above sea level, Morane's motor refused to work, and he fell three-quarters of the descent almost in a dead drop. By a supreme effort of will (he completely lost his presence of mind and felt dizzy and nauseated) he succeeded in moving the horizontal rudder so as to glide down the rest of the way. His plight was obvious, so rapid was his descent.

On September 8th at Issy-les-Molineaux Chavez reached a record height in a Blériot monoplane, ascending 8,790 feet. He says that after passing the height reached by Morane at Deauville on September 3rd, 8,472 feet, he began to feel that he could go no higher. The cold was intense. He continually felt as if his nose were bleeding. Then suddenly he caught sight of the liquid in the tubes in front of him and his heart sank when he saw that it was congealed. He resolved without hesitation to descend. He did not at first cut off the ignition on the way down.

He raced with a cloud moving in the same direction he was going. As he did not wish to penetrate it he rose slightly and glided ahead of it, giving it his back wash, so to speak. He cut off the spark at 500 yards from the ground.

Officials of the Aero Club report that a sealed needle barograph carried by Chavez marked between 8,427 and 8,463 feet. They are doubtful if the needle was placed exactly at zero before the start of the flight. Hence the record is reduced, but they are convinced that Morane's record was beaten.

The Current Supplement.

A novel and interesting form of construction of a reinforced concrete dock is described by Frank C. Perkins in the opening article of the current SUPPLEMENT, No. 1811.—A critical consideration of the increasing size of steamships is published.—Mr. John W. Titcomb presents the fourth instalment of his splendid treatise on "How Fish Are Hatched."—The outlines of the aeroplane in war are critically considered by a German military officer.—Mr. David S. Beyer presents another instalment of his splendid article on safety devices, in which he describes in detail the life-saving provisions of the United States Steel Corporation.—The manufacture of cordite is described.—G. Mareschal writes on the Dufay process of color photography.—Charles E. Benham discusses atmospheric electricity.—Recent progress in wireless telegraphy and wireless telephony is reviewed by H. Marchand.—A statistical inquiry in the iron resources of the world is published.

Correspondence.

EFFECTS OF OILED ROADS ON VEGETATION.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 27th you ask any of your readers to reply in matter of oiled roads as to the effect on trees and shrubs.

I have paid close attention to the effect, and on Vernon Avenue, Mount Auburn, one of our suburbs here, some fine Norway maples are dead, and the effect is plainly shown on all the trees, more so on the sides of the avenues on which openings were made in the past year for telephone and gas conduits.

On the hard macadam roads, where no openings have been made, and the oil has had an opportunity to harden before a heavy rain, the effect is not so apparent, but I am sure that the loss of many fine street trees can be traced to this.

On country roads that have few, if any, openings in them, the effect is not so apparent.

B. P. CRITCHELL, Landscape Engineer.

Cincinnati, Ohio.

EXTINCTION OF OUR MERCHANT MARINE.

To the Editor of the SCIENTIFIC AMERICAN:

In one of your recent issues, under the caption "Extinction of Our Merchant Marine," you were asked, What are we going to do about it? I would suggest that such laws be passed as will allow American ship owners to buy or build in the cheapest markets, all of which, as you are aware, are at present outside of the United States; such vessels to be granted American register. This will soon bring about a much larger tonnage under the American flag. An adjustment of wages, victualing, and the numbers of crews increased will soon be arrived at. Furthermore, our American builders will soon bring such conditions to pass as will enable them to compete with the foreigner.

Ship owning the world over at best is not a very remunerative business, especially to what is known as the "dry owner," that is, the owner who has no opportunity to make money out of the vessel through furnishing her with supplies or tending to her repairs, agency work, etc.

American capital would very soon find its way into American ships provided the present very impracticable flag law was removed. C.

New York, N. Y.

LENS REFRACTION OF SOUND.

To the Editor of the SCIENTIFIC AMERICAN:

In the August 27th issue of the SCIENTIFIC AMERICAN, G. C. wrote in the Query column regarding the refraction of sound by means of lenses, and wished to know the author of an old physics describing such refractions.

The work he had in mind was undoubtedly a school text called "Popular Physics," by J. Dorman Steele, the author of a very popular fourteen weeks' series in natural science, which were widely used some thirty years ago.

The lens refraction of sound is found in paragraph 3, page 161, with a demonstration in Fig. 122; revised ed. 1878.

These and many other experiments in sound I myself tried out some twenty-five years ago, and the above reference came to mind when reading query 12277.

There is a certain fascinating description and demonstration about these science series by Steele which seems to have been lost in most of our later text-books. The foot notes are the best ever produced. No other work in physics has ever had so near an approach to the clear fixing expression used by Prof. Steele as that used in the excellent popular work "Experimental Science," by Hopkins. L. M. DRAKE.

Daytona, Fla.

"MECHANIPULATE."

To the Editor of the SCIENTIFIC AMERICAN:

I have noted in the SCIENTIFIC AMERICAN of June 11th, 1910, the introduction of the word "mechanipulate," which is intended to designate the handling of a piece of work by a machine. Now, it appears to me that if a machine can handle a piece of work mechanically and without any human aid whatever, then it could be said that the work turned out by the machine was "mechanipulated." Just as the work handled by the human hand is said to be "manipulated."

Take for instance the typewriting machine. Consider its great facility and all of its valuable merits, with the great amount of work handled and turned out, compared with the human hand and pen. Is it not true that in spite of the many good points of this machine, we must say that not only the work, but the machine itself is "manipulated." Or indeed take the heat engine, which is in itself a great and highly developed machine which transforms heat into mechanical energy and transfers part of it to any machines within its range. Can it be said that the engine "mechanipulates" itself as well as the machines connected to it? Just because it may be said that it "mechanipulates" the steam? Or because of the fact that the human brain and hand conceived and made the engine as well as the machines connected to it, together with the pumps, boilers, etc., and because the human hand must feed fuel and water to the boilers before they can operate. Just as the engine would be useless without the engineer, should we say that they are "manipulated"? Or indeed is it not true that some word should designate a combined meaning of the two? If it is proper to say that an engine "mechanipulates" the steam, would it not be just as proper to say that the steam "mechanipulates" the engine? If this is the case, then it also "mechanipulates" the machines connected to it, and consequently it would seem quite right to say that the automatic hands and fingers of a screw machine "mechanipulate" the screws; but if "manipulate" as used in connection with automatic machines is distinctly a misnomer, it is because of the part which the automatic machine performs in the handling of the work; and as it is rarely if ever that a machine actually handles a piece of work without the aid of human hands, in one form or another, would not "mechanipulate," if used, be as much a misnomer as "manipulate" now is, when used as stated? With these facts before us, it appears that the word "mechanipulate" could be used within a certain limit, but in general I believe that it would be too much of an infringement on the hard-earned right of "manipulate;" and if any new word be used, I would suggest that it should designate a meaning combining the efforts of man as well as the efforts of the ingenious machine which man made.

P. S.—Having used the word "automatic" in connection with this letter, I think it should be remembered that this word or "automation" should not be overlooked when we attempt to apply the word "mechanipulate" to "automatic" machinery.

Philadelphia, Pa. JOHN S. EDWARDS.

THE AEROPLANE IN WARFARE.

To the Editor of the SCIENTIFIC AMERICAN:

I believe it was the SCIENTIFIC AMERICAN, a number of years ago, that first authoritatively stated that aerial navigation by heavier-than-air machines was an accomplished fact. The daily press at the time was skeptical about the reports of the flights made and cast doubt and ridicule upon the performances. It is, therefore, with a good deal of surprise that I read your editorial in this week's issue about the aeroplane in warfare, its possibilities and limitations. I am aware that many military and naval men have expressed themselves similarly regarding it, but members of any profession are always prone to decry any invention or method that would tend to revolutionize or abolish their own calling.

Will you permit me to call attention to several points that appear to have escaped notice, and it may be that perhaps the capabilities of the "plane" are not so greatly exaggerated as suggested.

As you say, to drop and hit an object from a flyer overhead is a difficult task. Yes, at the present. But this is practically a new "art," this dropping of explosives, like every other it would have to be developed and practised; and if the history of the ancient catapult or the modern gun is traced you will notice how clumsy the first attempts were. It is true to aim a missile from a thousand feet above would involve a knowledge of many conditions, but this knowledge can be acquired, and it would not require too much ingenuity to evolve an instrument equal to a modern range-finder that would minimize the chances of a miss, or make them at least equal to modern gun fire in accuracy. The bombs need not be "little" by any means, and in economy each shot or "drop" would surpass any of the present shells.

Then, explosives of high power and destructiveness have not, as yet, been developed for that particular purpose.

Military authorities have been prompt to suggest the vertical gun, or one that fires projectiles in a nearly vertical line, as a remedy against the planes. They all seem to overlook the fact that all projectiles, unless of a nature that actually vaporize, would eventually return to Mother Earth, and the more powerful the gun, the more disastrous the shot when it comes down. Those defending an aeroplane attack are, therefore, placed in the anomalous position of aiming their missiles at themselves, and unless their force be small and confined to a small area, would make that kind of defense impractical. Furthermore, even the object accomplished, a plane crippled and wrecked, have they realized that they are bringing down several hundred pounds of violent explosives upon their own devoted heads, thus serving the very purpose of the attacking force? A flock of twenty or thirty planes, each equipped with large quantities of especially powerful explosives, hovering over a fleet or over an army spread over a large area startles the imagination with its possibilities.

Looking at the matter logically, with an eye to the eventual development of aeroplanes, it does not seem to me that the "revolutionary" character in coming land and naval warfare is at all chimerical; in fact, there seems only one way to contend against them—by other aeroplanes; and the writers of fiction who have let their imaginations picture us coming battles in the clouds may not be very far from the truth after all. P. F.

New York, N. Y.

THE QUALIFICATIONS OF PRIZE CORN.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of June 4th, page 457, under the caption, "The Costliest Ear of Corn in the World," the writer of the illustrated article certainly is neither a farmer nor a judge of prize corn, else he would not leave the impression that an ear or ears ever won a prize because of size. That is never the case. The size of an ear of corn varies with the climatic conditions. In judging a sample of corn for a prize more than fifty points are considered, of which seven show very plainly in your illustration. They are these: The ears are all of the same length and of the same circumference; they are well filled at the butts and at the tips; the rows all run straight from the butts to the tips, and turn neither to the right nor to the left; the space between the rows is the same in all the ears, just enough for the corn to mature properly, and the ears all taper the same at the tips and at the butts. Now let me refer to just a few points that cannot be determined by looking at the illustration. If the germ and the embryo have not a certain color and a certain consistency, we know that the kernel will not have vitality and that it will not grow uniformly. This condition will reject a sample of corn that is entered for a prize even if it has all the other good points shown in your illustration. In the last you will see that two kernels are taken from each ear, generally more than two are taken. This is done to see if it has the proper germinating power, to see if the chaff adheres to the tips of the kernel or if the tips of the kernel adhere to the cob and if the tips of the kernel are plump. If they are plump it indicates maturity, if shrunken, immaturity and poor feeding value. If the kernel is removed it is easier to see if it has the proper amount of starch, which is a point for the judge to consider. The depth of the kernel must be in proportion to the length and to the circumference of the ear. The edges of the kernel should touch from tip to crown; consequently they must all be wedge-shaped. The kernels should hold their size and shape well out to the tip of the ear, and must be uniform in size, shape and color in all the ears of a sample. The dent of the kernel must conform to the type; different types having different dents. White cob in a yellow sample of corn, or a red cob in a white sample would not win a prize, no matter how large the ears, for it shows impurity. If the furrow is wide between the rows it shows a low proportion of corn to the cob, and indicates that it is not well bred. We have enumerated only a few points that are taken into consideration in the judging of prize corn, but enough to show that it is not the size of an ear, but its breeding and its power to reproduce itself that win for its owner a prize. The writer of the article says: "The champion ten ears of corn shown in the illustration average 10½ inches in length and 7¾ inches in circumference, each ear carrying 20 rows of kernels, the depth of the kernel being ¾ of an inch, and the weight of each ear is 20 ounces." All of this shows that those ten ears of corn have had forty or fifty years of careful, intelligent selection and improvement back of them. They have been mixed with brains; they will reproduce themselves. A stalk now produces double the amount of corn that it did fifty years ago. That is what scientific farming has done for us, and yet there is more to learn. To close his article, the writer says: "Lastly, it must be considered that from a large field of corn some large specimens may be selected." This does not prove that the selected specimens are the best, but merely the largest. No intelligent farmer selects the largest ears of corn in his field either for use as seed or to contest for a prize, but he takes ears that are suitable to the climatic conditions, ears that will ripen in the vicinity not only this year, but for a succession of years. Ears of the size you illustrated are suitable for Southern Iowa, Central Illinois and Southern Indiana. I don't know who grew them, but I will be safe in wagering that they were not the largest ears in his field, and probably more than one-third of the ears in that field were larger than those that took the prize. I have been a subscriber to the SCIENTIFIC AMERICAN for more than twenty years, and for the purpose of my farming operations, have found in its columns valuable reading.

Wever, Iowa. JOSEPH FRY.

According to the German journal Prometheus, there are in operation 12,171 lighthouses and lightships of all grades on the coasts of the Atlantic Ocean, 2,288 in the Pacific, 677 in the Indian Ocean, and 88 in the Polar seas.

THE HARVARD AVIATION MEETING

A RECORD DAY BY DAY

The Harvard aviation meeting is the most important thus far held in the United States.

Cash prizes to the amount of $6,000 will go to the aviators having the best three scores for speed by points at the end of the meet—$3,000 to the winner, and $2,000 and $1,000, respectively, to his two closest rivals. The sum of $4,000 will be divided among the three best men in the duration contest of the week, and another $4,000 among the winners in the distance events, $2,000 being awarded to the first man in each event, and $1,000 each to the second and third. The prizes for altitude amount to $6,000, of which $3,000 goes to the contestant making the largest number of points for altitude; $1,000 to the man with the second largest number of points, and an extra $1,000 for a new world's record.

The Boston Globe offered a prize of $10,000 for a flight of 33 miles in the shortest time over the water around the Boston Light and return to the aviation field twice in succession without alighting.

John B. Ryan, of New York, offered, through the Harvard Aeronautical Society, a trophy in the form of a bronze bust of Commodore Barry, as a prize for bomb-throwing from aeroplanes. Only members of the United States Aeronautical Reserve, the national organization which is being formed by Mr. Ryan and Clifford B. Harmon, were allowed to compete for the tropny so far as Americans are concerned. Foreigners are allowed to compete, however, even though they were not members of the Reserve, a distinction which is made to foster the growth of the organization in this country.

The bombs must be dropped from a height of at least 100 feet, and the trophy must be won by an aviator at least three times, not necessarily in succession, before he owns it permanently. Each winner of a contest will get a duplicate of the trophy, and he may retain his duplicate until the original trophy is won permanently, whereupon the duplicate will be recalled. A hit anywhere within the deck of a model man-of-war counts one point; a hit within four feet of the outer rim of either of the funnels, three points; a hit within two feet of the rim, five points; and a bull's eye, or center shot, inside the circles, indicating the smokestacks themselves, counts ten points.

A chronicle of the events up to and including September 9th follows:

September 2nd.—Grahame-White in his Blériot monoplane, made his first flight in this country, one day before the opening of the Harvard-Boston meeting. With him in the air at the time was Cromwell Dixon, of Columbus, Ohio, who manned a dirigible airship. Grahame-White rose to a height of about 1,000 feet, made a circle of about four miles, swinging well out over the harbor toward Boston Light, and then over Dorchester. He stayed in the air about 6 minutes, and covered nearly a mile a minute.

September 3rd.—The aviation meeting was officially opened despite overhanging clouds which finally deluged the field with rain. Fully 10,000 men and women sat in the grand stand until darkness brought the day's flying to an end.

The proceedings were opened at 8:45 o'clock, when Grahame-White started off in his Blériot monoplane. He covered 6 miles of the three laps of the field in 7 minutes 7 3-5 seconds, rising to a height of about 400 feet. At about a quarter after 12 in the afternoon, to the strains of "The Star-Spangled Banner," Clifford B. Harmon officially opened the meeting. He made one circuit in 1 minute 59 seconds. When the band played "God Save the King," Grahame-White went up and made a complete round of the course. The real contest, however, did not begin until Ralph Johnstone, Willard, and Brookins started out in their biplanes to compete for honors and prizes. The three aviators were in the air at the same time and for a while Grahame-White circled around with them. Later in the afternoon Glenn Curtiss came out and ascended. Two accidents occurred; Clifford B. Harmon's biplane was wrecked during a too rapid descent, and the motor of Ralph Johnstone's Wright machine gave out after he had been in the air one hour and twenty minutes.

Johnstone secured first place for the day, at least, in both the endurance and distance contests, by making 22 laps of the course. His time in the air was 1:20 1-3, and his distance traveled 38½ miles. Brookins was second with 11 laps. He was in the air 46 minutes 4 seconds, covering 19¼ miles. White was third in both contests, with 10 laps in 30 minutes and 45 seconds for 17½ miles. Summarizing the events of the day, it may be stated that Mr. White did some splendid work in bomb-throwing, landing two of his ten shots in the funnels of the model battleship, while all but one of his other shots dropped on the battleship's surface. In his speed work, he did the ten laps in 30:45. White's total for the three laps was 6½ minutes, which gave him first place in the event for the day.

At the end of the day the men had the following standing under the system of points which prevailed: White, 9; Johnstone, 4; Brookins, 2; Willard, 2.

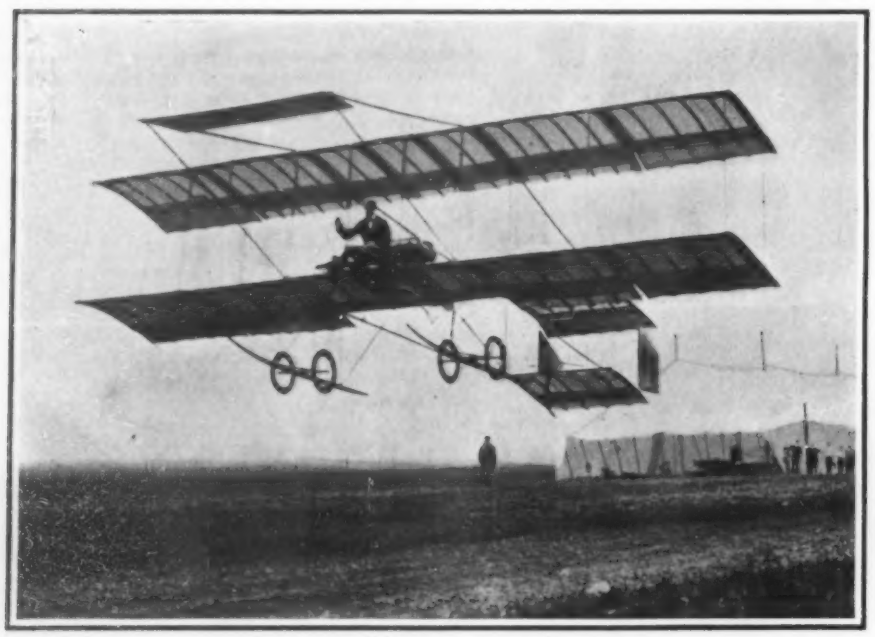
September 4th.—Owing to the expressed desire of President Lowell, of Harvard University, no exhibition of any kind was permitted on Sunday, and the grounds were closed to the public. Cromwell Dixon, however, made an ascension in his dirigible which nearly proved disastrous. After circling the field at a height of 500 feet, his engine stopped and the airship started to drift out to sea. Realizing his danger at once, Dixon tried to effect a landing by running forward on his frame and forcing the bag down head first. This ruse failing to work, he dropped his anchor rope. It tangled, however, and it was some time before Dixon was able to untwist it and throw it down to the few mechanicians who were on the field. They caught it and pulled him down, Dixon meanwhile letting out gas. When the balloon came down, it was only 10 feet from the water's edge.

September 5th.—On September 5th, twenty-seven flights were made between morning and night. These flights were not unattended with mishaps. Horace F. Kearny ran his Pfitzner monoplane into a wire fence, with some slight damage. A. V. Roe's English triplane made two attempts at flying; after the second the aeroplane dug its nose into the mud.

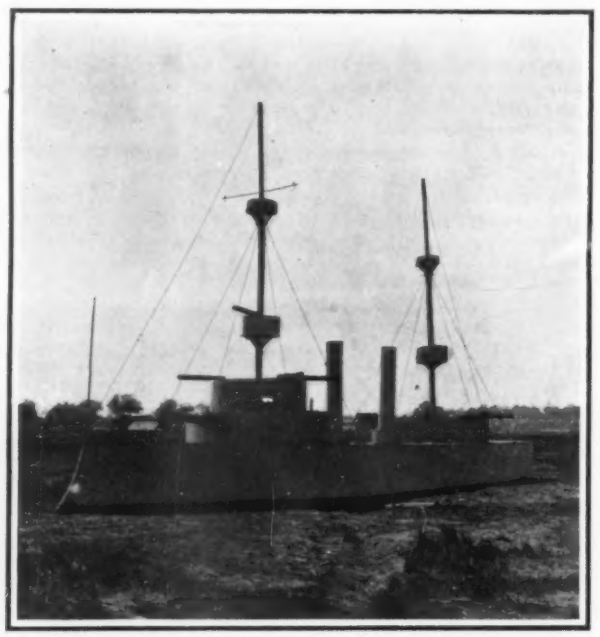
At one time, four machines were in the air, Grahame-White in his Farman, Johnstone in his Wright, and Curtiss and Willard in their Curtiss machines. White's flights for distance and duration records were ended by the breaking of an inlet valve of his engine.

Ralph Johnstone in his Wright machine was still in the lead in the duration and distance event. To flight lasting 80 minutes and 12 seconds, which he made on September 3rd, in which he covered 38½ miles, he added 26¼ miles in 46 minutes and 32 seconds.

The feature of the day's flights was Grahame-White's performance in the speed and bomb-throwing contests. In the afternoon he established a track record in his Blériot for speed, when he circled a mile and three-quarters in 1 minute 57 1-5 seconds. When he started upward for his duration flight, he carried with him a stock of "bombs" to drop upon the outline of a battleship 200 feet long which was placed in front of the grandstand. The bull's eye (the smokestack) counted ten points. Out of the 20 shots made by Grahame-White, ten on September 5th and ten on September 3rd, he scored 58 points out of a possible 200. Grahame-White made one bull's eye shot, and several times hit the deck close to the funnels. The professional aviator who, at the close of the meeting, has scored the highest number of points for hits, receives a $5,000 cash prize, and the amateur who achieves a like success a handsome trophy.



Grahame-White ascending in his Farman biplane.



The model battleship used in bomb-throwing contest.

THE HARVARD INTERNATIONAL AVIATION MEETING.

In the bomb-throwing contest, Willard and Curtiss competed with Grahame-White. Willard's shots landed on remote parts of the deck. Curtiss, in two trials, made a bull's eye on the funnel and 7 hits on the deck, out of 8 shots on one entry, and struck the battleship 9 out of 10 times on his other attempts.

Grahame-White's distance record of the day was 45 miles 617 feet, on which trip he was 1 hour 16 minutes and 7 seconds in the air. Johnstone, in his Wright biplane, was second with 26 miles 3,107 feet, which distance was covered in 48 minutes and 54 2-5 seconds.

Grahame-White was the only man who competed in the get-away. It took him 110 feet 8 inches to get his Blériot monoplane off the ground, and 177 feet 2½ inches to raise his Farman biplane.

The contestants in the speed contest were Grahame-White, Curtiss in his own machine, and Willard in another Curtiss. Grahame-White covered the distance in 6 minutes and 1 second, Curtiss in 6 minutes and 31 seconds, and Willard in 7 minutes 38 4-5 seconds.

On one of his flights, Grahame-White took up with him Miss Marie Campbell, of New York, in his Farman biplane. Mr. Willard took up with him a Boston newspaper man after Miss Eleanore Ladd's trip with him. Willard also took up Miss Phœbe Dwight, representing a Boston paper, in his Curtiss biplane, and carried her twice around the field.

The points to date were as follows: Grahame-White, 68; Curtiss, 27; Willard, 13; Johnstone, 6; and Brookins, 2.

September 6th.—The feature of the day's meeting was Grahame-White's attempt to win the Boston Globe's $10,000 prize for the quickest flight to Boston

Light and return twice over, a prize which may be contested for any day during the meeting. Starting at 4:30 o'clock in his Blériot monoplane, he made the complete trip twice around the course, 33 miles, in 41 minutes 35 seconds. In going out to the Light, he kept at a level of about 300 feet, but after he circled the Light he ascended 1,000 feet.

Before he started out for the Light, Grahame-White circled the course three times in a trial for the best speed record. He made the three speed laps, or 5¼ miles, in 6 minutes 15 3-5 seconds, not so good as his record of the previous Monday. Glenn H. Curtiss made a trial for the speed record, his second during the meet, but was unable to approach Grahame-White's mark. Curtiss covered the three laps in 6 minutes 29 4-5 seconds.

Next to the flight to the Boston Light, interest centered during the afternoon on the lofty climbs of Johnstone and Brookins of the Wright camp, as well as of Willard, who climbed to a height of 3,040 feet, the highest thus far recorded in the meet.

In the day's trials for accuracy in landing, Curtiss, in the famous machine in which he made his Hudson River flight from Albany to New York, surpassed Mr. Grahame-White, the Englishman's Farman machine overshooting the circle center 162 feet 6 inches before he stopped it. Curtiss landed within 63 feet and 10 inches of the mark.

Brookins, of the Wright forces, made three slow laps around the course, and managed to consume 13 minutes and 48 seconds in doing 5¼ miles. For the slowest three laps during the meet, there are special prizes of $1,000 and $500. The slowest officially recorded work of this type was by Capt. Dickson of the "Lanark," made when he took 4 minutes and 5 seconds to cover one and seven-tenths miles, which is at the rate of 21.29 miles an hour.

In his altitude trials, Johnstone remained in the air continuously for 1 hour 27 minutes 24 2-5 seconds; Brookins, 26 minutes 29 1-5 seconds, and Grahame-White 16 minutes 49 1-5 seconds.

September 8th.—All told, there were 18 events. President Taft visited the aviation grounds and watched simultaneous flights by Claude Grahame-White, Johnstone and Curtiss. Grahame-White took up Mayor John F. Fitzgerald in his Farman biplane for three laps around the field.

Among the passengers carried up, besides Mayor Fitzgerald, were James F. Lord, formerly of Chicago, who was taken up by Grahame-White in his Farman, and Lieut. Bailey of the torpedo boat destroyer "Stringham," who went up with Willard. Roe's machine was wrecked in landing from a short low flight in the morning, and was very badly damaged.

Burgess made a successful flight in his machine. William H. Hilliard, in another Burgess machine, succeeded in making a short flight. Horace F. Kearny succeeded in getting the Pfitzner monoplane off the ground after it had been repaired from its last wreck.

Grahame-White scored first in the speed, get-away, accuracy, and bomb-throwing contests. He was hard pressed, however, by the two Wright flyers, Johnstone and Brookins, who, respectively, won first and second in the duration test, and Johnstone won first in distance.

Grahame-White made 17 hits in the bomb-throwing contest against three by Willard. One of the Englishman's bombs dropped squarely into the funnel. Grahame-White made another new mark for the meet when, in the accuracy in landing test, he came down in a 100-foot circle and stopped 33 feet and 4 inches from the center.

Johnstone, in his Wright biplane, outdid himself in slow flying. He made the 5¼ miles in 12 minutes 46 3-5 seconds. The day's events may be summarized as follows:

Speed (course 5¼ miles)—First, Grahame-White, 6:05 1-5; second, Curtiss, 6:52 3-5; third, Willard, 8:22.

Duration—First, Johnstone, 1:6:42 3-5; second, Brookins, 56:10 4-5; third, White, 17:3.

Distance—First, Johnstone, 33 miles 3,104 feet.

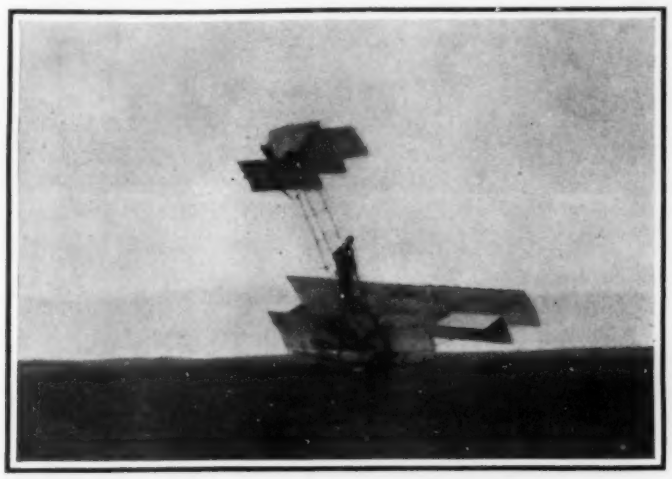
Slow lap (course 5¼ miles)—First, Johnstone, 12:46 2-5.

Getaway—First, White, 69 feet 7 inches.

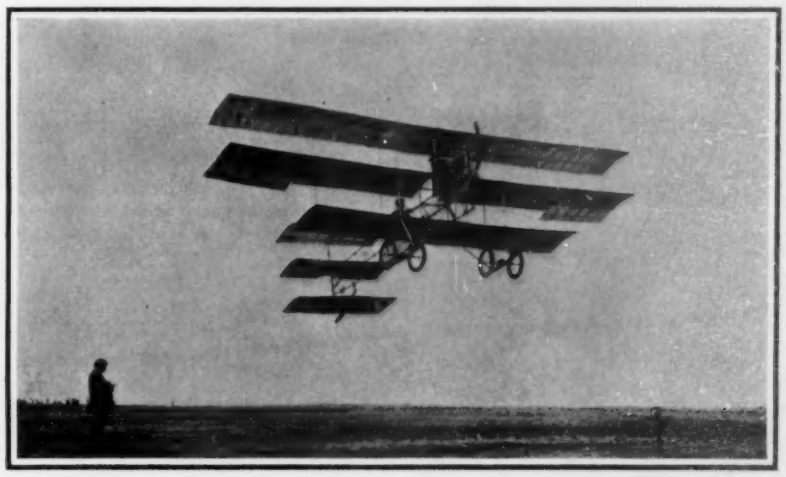
Accuracy—First, White, 33 feet 4 inches.

Bomb throwing—First, White, 17; second, Willard, 3.

September 9th.—Claude Grahame-White smashed his Farman machine in attempting to land while drifting across a puffy wind a few minutes before the flights for the day came to an end. The aviator escaped uninjured, but his propeller and the upper and lower right wings and allerons were crumpled up.



Roe's triplane in a bad downward plunge. The aviator was photographed just as he was about to leap back out of the machine.



A. V. Roe's triplane which came to grief. Although the machine was in the air it established no record and had no chance to compete with the other machines.

Not three minutes later Walter Brookins, most skillful of American aviators in handling an aeroplane under difficulties, approached the same landing in a Wright machine, flying over the same air path. Instead of attempting a landing across the pummeling northwest wind Brookins when above the landing spot swung away from it and beyond for a few yards into the southeast with the wind at his back. Then he turned around sharply into the wind and landed with a gentle glide about fifty feet from where the wrecked Farman lay.

Graham-White made a new American record in the getaway in his Farman biplane. Upon his fourth try from the starting point he rose into the air after a run of only 26 feet 11 inches.

Grahame-White also holds the world's record for quick rising with a run of 20 feet 9 inches at Blackpool, made some months ago.

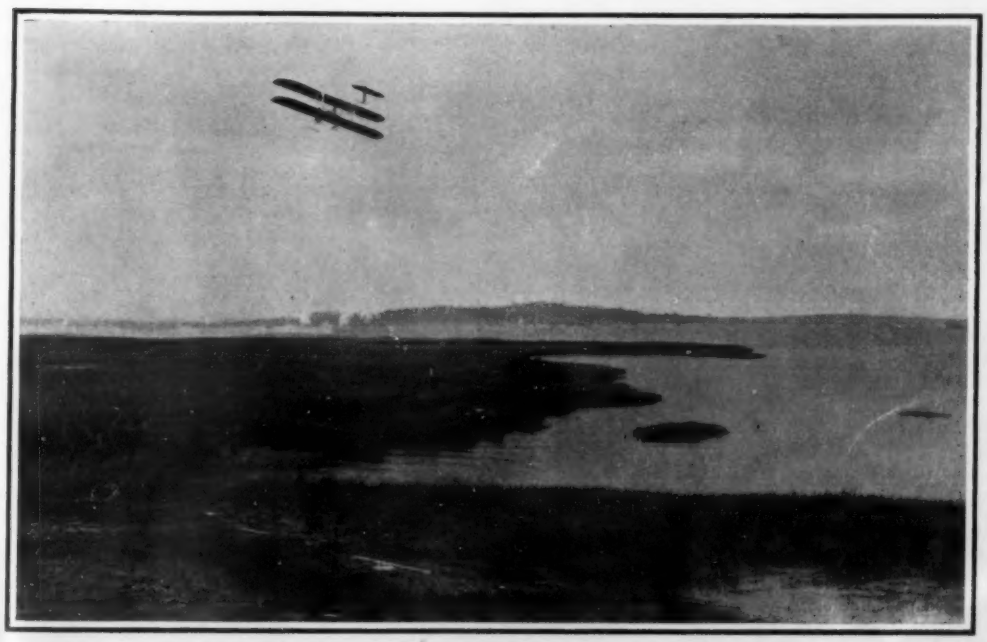
The aviators made the following scores for the day:

Grahame-White—Getaway, first, 54 feet 6 inches; getaway, second, 39 feet 10 inches; getaway, third, 26 feet 11 inches; accuracy, first 68 feet 6 inches; accuracy, second, 36 feet; distance, 19 laps, 33 miles 1,320 feet; duration, 1 hour 9 minutes 18 1-5 seconds.

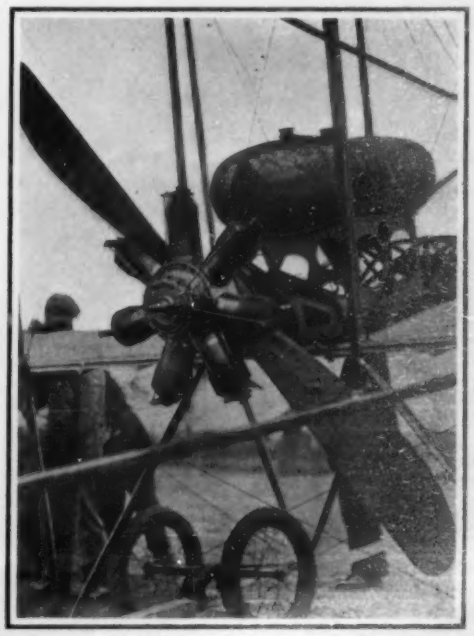
Johnstone—Distance 16 laps, 28 miles 4,557 feet; duration, 61 minutes 23 4-5 seconds.

Willard—Speed, 3 laps, 8 minutes 21 3-5 seconds; distance, 5 miles 1,320 feet; duration, 8 minutes 21 3-5 seconds; getaway, first, 110 feet 7 inches; getaway,

(*Concluded on page 227.*)



Johnstone in his Wright machine hovering over the harbor.



The Gnome engine of Harmon's Farman biplane.

THE HARVARD INTERNATIONAL AVIATION MEETING.

MAGIC FOR AMATEURS—X

MISCELLANEOUS TRICKS

BY W. H. RADCLIFFE

NO. 22. A MAGNETIZED CANE.

The principles involved in magnetizing a cane as here described can be applied equally well to a table knife, a billiard cue, or any similar article. No preparation is necessary. The article used is first stroked lengthwise by the performer's hand to apparently magnetize it. It is then taken in his left hand while he stands with his left side toward the audience, and while held at the center parallel to and against the extended palm, is pushed down toward the fingers by the pressure of the right hand fore-finger upon it

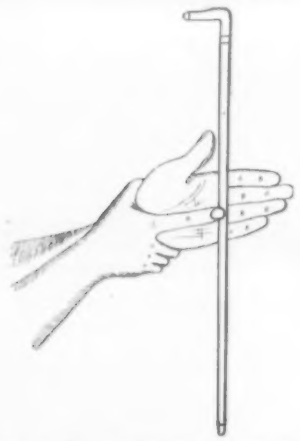


Fig. 35.—METHOD OF GRASPING WRIST AND MAGNETIZED CANE.

from the rear. The remaining fingers and the thumb of the right hand are grasped around the wrist of the extended left hand as illustrated in Fig. 35.

As seen by the spectators the article appears to hang unsupported by the left hand. Spreading apart the left-hand fingers and shaking the left hand up and down, strengthens the illusion. A considerably greater distance can be covered by the extended fore-finger than is generally supposed, and this, together with the fact that the right hand appears as a whole to be circling the left wrist, accounts for the effectiveness of the illusion.

NO. 23. SOME MAGICAL DYEING.

A very effective color-changing trick can be done with four silk handkerchiefs or four pieces of similar light weight dry goods, two of one color and two of another color, but all of the same size.

For use in connection with the handkerchiefs a

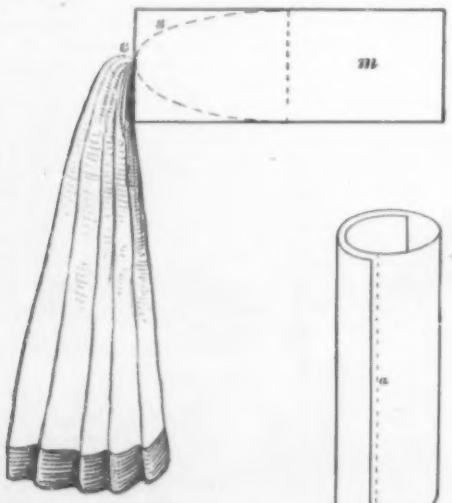


Fig. 36.—TUBE IN WHICH THE TRANSFORMATION OCCURS. HANDKERCHIEF SEWED TO END OF POCKET.

Fig. 37.—PAPER SCREEN FOR TUBE SHOWN IN Fig. 36.

sheet of stiff white paper nine inches square, and a four-inch length of pasteboard mailing tube about one and one-half inches in diameter, are required. The tube should have sewed within it, midway between the ends, a black linen bag of such size that it will just reach to the end of the tube as indicated by the broken lines *s* in Fig. 36, where the tube is represented by *m*. One of the handkerchiefs should be sewed at the center to the bottom of the bag as shown at *c*.

In preparing for the trick, the paper sheet previously mentioned is lightly marked with a pencil as shown at *a*, Fig. 37, to indicate how far it should be rolled up so that the pasteboard tube can be slipped easily within it. An elastic rubber band should be provided to encircle the paper tube to prevent it unrolling. The handkerchief fastened to the bag must be pressed into the tube, and next it is placed the other handkerchief of the same color. Both should be pressed as far back into the tube as the bag will permit so that they will be entirely concealed.

One of the remaining handkerchiefs is opened and placed upon a table, the loaded tube laid upon it with the empty end toward the rear, and over the tube so as to screen it from the spectators, the fourth handkerchief is carelessly thrown. To enable the performer to readily locate the tube, its empty end is left exposed to his view, so that he can grasp it off-hand in taking up the handkerchiefs.

In presenting the trick, the performer shows the white sheet of paper, Fig. 37, then standing in full view of the audience he rolls it into a tube of the proper size as determined by the pencil mark upon it, slips the elastic rubber band around, and passing his wand through, shows the tube empty.

He now steps to the table with the paper tube in his left hand, grasps the pasteboard tube and the two exposed handkerchiefs in his right hand, holding the pasteboard tube so that it is well concealed both by his hand and the handkerchiefs around it, and then slowly proceeds to insert the handkerchiefs into that end of the paper tube held toward the audience. Under cover of doing so, he first inserts the pasteboard tube, and as soon as it is well inside, tightens his grip on it by pressing more tightly upon the paper tube with the thumb and fingers of his left hand; then, remarking that it would perhaps be easier and the spectators would probably be better able to follow his movements if the handkerchiefs were inserted separately, he pulls them out again and inserts them one by one, using his wand to pick them up and to poke them in.

While doing this he explains to the audience that the passage of the handkerchiefs through the paper tube changes their color; in other words, that the tube acts as a dyeing device. When one of the concealed handkerchiefs has been forced partly out of the end of the paper tube by the insertion of the exposed handkerchief and wand into the other end, the performer grasps it with his right hand and draws it entirely out, holding it up so that the spectators can see both sides.

After the second exposed handkerchief has been entirely pushed in by the wand and the second concealed handkerchief appears at the opposite end, he draws this out also, but pulls it slowly, allowing its edges to fall around the paper tube. Then grasping it near the center he brings it entirely out, and with it the pasteboard tube into which the original handkerchiefs have been pressed, but allows the edges of the now exposed handkerchief to conceal the tube from the spectators. After this handkerchief has been held up so that the audience can see it, it is placed upon the other handkerchief on the table, care being taken to keep the pasteboard tube well inclosed within its folds.

The paper tube may now be unrolled before the spectators and shown empty, or left rolled and tossed to the audience for examination.

NO. 24. THE TRAVELING DIE.

Procure a playing block or other square block of wood measuring about three inches on a side, and paint it to represent a die by first giving it a coat of black paint and then with white paint marking the spots on it—one and six on opposite sides, two and five on opposite sides, and three and four on opposite sides.

Around this die which is shown at *A*, Fig. 39, build up with stiff cardboard and mucilage or with tin and solder, a hollow die *B*, one side open, making it just large enough to slip easily over the wooden block. Paint the sides of the box thus formed so that they correspond with the block, making the white spots about the same size. A cardboard cover *C* for the hollow die completes the outfit. This cover should be made the same as the hollow die except that it should be about one-eighth inch larger and more ornamental. Colored paper or cloth of Oriental design pasted over the cardboard gives the desired ornamental effect.

As an introduction to the trick the following piece of nonsense is appropriate: Obtain from the audience two stiff hats and place them brim downward, several feet apart upon a table. Let the spectators examine the solid wooden die and then place it under one of the hats. Command the die to pass from the one hat to the other. Without raising the hats, to illustrate your point, assure the spectators that the die has obeyed you.

Then tell them that what has just taken place, although wonderful in itself, is tame in comparison with what you will now force the die to do. Advise them to watch closely, and that if their eyesight is sufficiently strong they will see the wooden block travel backward, because you will make it go slower this time. Repeat the incantation previously used, and then raise the hats. As the die will, of course, remain where it was originally placed, it will now

Fig. 38.—THE DIE IN POSITION TO PASS THROUGH HAT.

be in the proper position for exhibition. Those in the audience too dull to see through the trick will marvel at it; the others will appreciate it as a good joke and laugh themselves in condition to enjoy the real mysteries of "The Traveling Die," which should be presented as follows:

The performer takes the solid die in one hand and the cover with the hollow die within it in the other hand. He lays these upon the table, placing the cover so that the spectators do not see the hollow die. He then arranges the two hats brim upward and calls attention to the solid die being simply a block of wood, letting it fall upon the table to prove its solidity. Picking up the cover and explaining that it is an ordinary one, he drops the solid die within it, turning it so that the corresponding sides of both solid and hollow dice have the same number of spots; then tipping over the cover, he allows the solid die with the hollow one over it to drop into his hand, and carelessly tosses the two together into one of the hats.

After holding up the cover so that the spectators can see there is nothing in it, the performer apparently takes out of the hat the solid die, but in reality the hollow one, and places it open side downward upon the crown of one of the hats, which is then placed upon the other hat, as in Fig. 38. Placing the cover over the hollow die, the performer waves his wand, and commands the die to pass through the hat. A slight pressure upon the sides of the cover in raising it will hold the hollow die within, and if the performer immediately places both upon the end of his wand the cover will appear

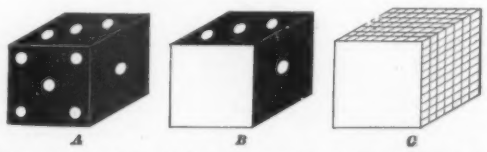


Fig. 39.—A SOLID AND A HOLLOW DIE AND COVER FOR USE IN TRAVELING DIE TRICK.

empty. The solid die will, of course, be found and shown in the lower hat.

By reversing the procedure, the die can apparently be made to pass from the lower hat to the crown of the upper one, and then back again as before.

It is surprising that paper, which is used for wagon wheels, has not yet been adopted for the manufacture of automobile tires. An ingenious inventor has now undertaken to replace the strips of rubber used in automobile tires by compound strips of paper attached to each other by chemical binders under great pressure. These paper tires are claimed to be as strong as steel, and as elastic as India rubber, impervious to water and oil, and remarkably silent in action. The additional advantage is claimed for them of picking up small pebbles, and thus becoming automatically sanded, so that skidding is impossible.

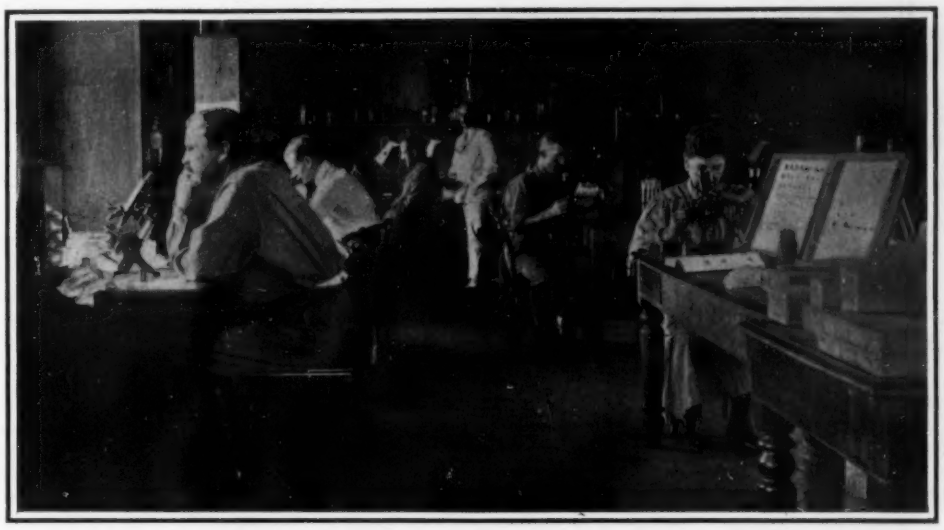
INVESTIGATING THE SLEEPING SICKNESS OF UGANDA

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN

One of the most important scientific investigations in which the Royal Society of Great Britain is at present engaged is the study of the origin, and means of combating, the sleeping sickness in Uganda. It was between 1896 and 1901 that this terrible malady broke out in the colony, and it spread with such rapidity that the British government was forced to cope with the epidemic. A commission was organized by the Royal Society, under the directorship of Col. Sir David Bruce, C.B., F.R.S., and a laboratory was established in the stricken area to study the question intimately on the spot. The first expedition set out in 1902. Since that time, two other commissions have been dispatched to the country, the last in 1908. They have accomplished valuable work, and have contributed extensively to our knowledge of this fell disease. Through the courtesy of Sir David Bruce, we are enabled to describe the characteristics of this enterprise. The conquest of sleeping sickness is rendered extremely difficult owing to its insidious nature, the method of propagation and contamination, and the fact that one may be affected many years before the usual symptoms are manifested. The disease is essentially a disturbance of the functions of the brain, and a slow chronic inflammatory process takes place in the brain substance, which in time gives outward evidence that a person is afflicted. For a long time, however, in some cases years after infection, there is no suspicion that anything is wrong, and an affected person may go about and pursue his duties in the ordinary manner without betraying the slightest sign of trouble. Then a slight change in demeanor gradually takes place. There is less inclination to exertion, the victim lies about, and then the first signs of coming fatality become obvious. The face grows sad, heavy, dull-eyed, and apathetic. The patient will however be well nourished, but an examination of the pulse shows it to be weak and tremulous; there is weakness and uncertainty in the walk, the voice is indistinct, thin, and monotonous, the temperature is of a most irregular character, rising and falling within a few hours to extreme degrees, and in the last stages the victim keeps to his bed in a lethargic condition, the temperature gradually falling as the vital forces become extinguished.

Prior to the nineties, sleeping sickness was unknown in Uganda, and its introduction is attributed to the entry of Emin Pasha and his 10,000 followers who were settled in Busoga, and who were brought from the edge of the Congo territory, the center of the disease. This theory is supported by the fact that the malady first made its appearance in the country lying to the east of Busoga, and once it secured a foothold it spread with alarming rapidity. For some time before, the authorities were greatly puzzled by the illness, and it was only in 1901 that it was first definitely diagnosed. Some idea of the manner in which it struck down the natives may be gathered from the fact that the island of Buvuma in the north of Lake Victoria Nyanza had in 1901 a population of 22,000; in 1903 there were only 8,000.

The first government work was the definite location of the disease, and the distribution was found to be very peculiar. Dr. Hodges, one of the Uganda colonial surgeons, prepared a map, which shows that it was confined to the numerous islands skirting the northern shores of the Victoria Nyanza and a narrow belt of country a few miles wide along the mainland forming the northern shores of the lake. This territory was the most thickly populated, with about 100 inhabitants to the square mile, but in many cases the people have been completely wiped out. The characteristics of the disease pointed to a malignant parasite being the cause of this peculiar malady; and although various theories were advanced, it was only elaborate microscopical research that conclusively answered the question. When the blood from an afflicted person was examined under a high-powered microscope, an active wriggling parasite was discovered, known by the name of trypanosome, and belonging to the lowest group in the animal kingdom. It comprises a single cell, and in its best form is a worm-like creature, extremely lively in its movements, constantly dashing about, lashing the red corpuscles into motion, and swimming equally well with either extremity in front. Elaborate examination of the blood of stricken people was carried out, the specimens being drawn either from the veins, or the clear cerebro-spinal fluid filling the various cavities of the brain secured by means of a hollow needle; and in forty cases, with patients ranging from eight to fifty years of age of both sexes, this trypanosome was found in every instance. For comparative purposes, the blood of hospital victims suffering from other maladies was examined, but in no case was this parasite discovered. The next stage was to ascertain whether trypanosome was really the cause of the disease, so natives were examined from the sleeping sickness area, and beyond its limits. In the former district, out of 80 natives tested, 23 were found to have the parasite in their blood, but in the latter instance among 117 people not a trypanosome was found. The scientific staff thereupon determined to test the result of their deductions upon one of the lower animals. The most suitable in the vicinity of Entebbe, where the laboratory was established, was the native monkey, which thrives here prolifically. After the infective material was injected, for a long time the animals showed no evidences of the malady, the temperature remaining normal and the appearance being one of perfect health. In the course of a few months, however, the fever set in; they became lethargic, sitting about all day, and taking but little interest in their surroundings. In the last stages they sat all day with heads bent on their chests as if asleep. The experiments proved that these trypanosomes were responsible for the malady.



Colonel Sir David Bruce with staff at work in laboratory at Mpumu, Uganda, investigating sleeping sickness disease.

Natives bringing bananas to camp to sell for monkey's diet.

The point then arose as to how the parasite was distributed. It was known that the tsetse fly was responsible for the terrible rinderpest among cattle in South Africa, and a biting insect which thrives in great numbers on the shores of the lake was suspected. This is a member of the tsetse species, and is known as *Glossina palpalis*, and when caught was recognized by the native authorities as the kivu. These functionaries were supplied with nets, bottles, and boxes, and they promised to catch large numbers of this insect and biting flies of all kinds. Each consignment of dead flies was carefully labeled as to the point at which it was secured, and in all 460 collections were sent to the laboratory. When the tsetse fly was discovered, a red disk was attached to a large map at the point where the specimen was captured. If the tsetse fly was absent, a blue disk was affixed to the map at the collecting point. When this map was compared with another on which the area of the sleeping sickness was indicated, it was distinctly seen that the territories coincided wherein the suspected fly was to be found and where the contagion was prevalent. It was moreover discovered that this fly only flourished where the shore of the lake was a thick jungle, with dense dank undergrowth and towering trees. It was never found on the open beach. Curiously enough, it was in the dense jungle stretches that the natives congregated to carry out their trading in fish, bananas, etc.

The next step was to ascertain if the fly could carry the infection. This phase was tested on the monkeys. Tsetse flies were fed on an afflicted person, and were then removed to cages containing healthy monkeys, and examinations of the latter a few days later proved that the fly had communicated the epidemic.

The authorities then took drastic measures to stamp out the plague, and to have the laboratory working on the spot. Concentration camps were established, and every possible method was adopted to render the natural breeding ground intolerable to the fly. The laboratory was removed from Entebbe to Mpumu, at an altitude of 500 feet on the

(*Continued on page 225.*)

Separate open air monkey boxes erected in preference to ordinary house or cage.

INVESTIGATING THE SLEEPING SICKNESS OF UGANDA.

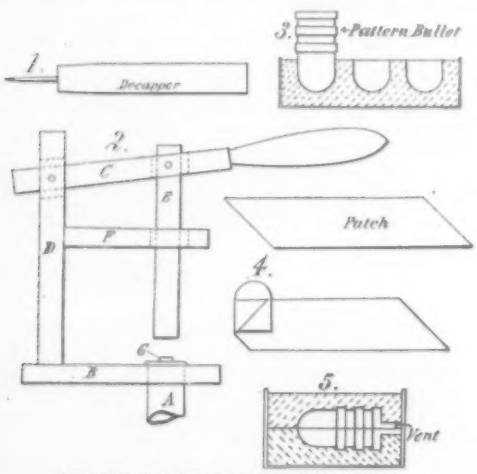
RELOADING TOOLS AND BULLET MOLDS.

BY AUGUST MENCKEN.

The young rifleman who uses his rifle much, soon finds the cost of ammunition a serious hindrance to his pleasure, and the cost of reloading tools a little beyond his means. Both of these difficulties can be overcome by making the tools himself, and this is easily done. The tools described below are adapted for the .45-70 cartridge, but by following the general directions they can be made for any center-fire reloadable shell.

The first tool used is the decapper, and this is very easily made. Turn up a piece of steel so that it will fit the shell snugly and reach to the bottom. The inside of some shells is tapered, so this will have to be taken into consideration. In the center of the end that fits into the shell, bore a 1/32-inch hole about ½ inch deep, and into this fit a hard steel pin ¾ inch long, as shown in Fig. 1. The shank of a 1/32-inch drill answers very well for this purpose.

After the shell is decapped and cleaned, see that there is no burnt powder or dirt in the cavity from which the cap was driven. The shell may be recapped. The construction and use of the recapper can easily



RELOADING TOOLS AND BULLET MOLDS.

be understood by referring to Fig. 2. The shell *A* fits through a hole in the base *B*. The handle *C* is pivoted to the upright *D*, and works the plunger *E*, which passes through the guide *F* and forces the cap *G* into the shell. White pine is a good material to use; it is strong enough to do the work, but is not hard enough to injure the cap.

After the shells have been recapped, *never before*, they may be loaded. Powder measures for different ranges can be made of old shells. For a full-load measure draw the bullet from a factory-loaded cartridge, and measure down on the inside to the top of the powder. Take an old shell and cut it off at this distance from the top, solder on a handle, and the measure filled to the top is the full load. Cut the shells off at different points to give half, quarter, or any load desired.

The shells are now ready for the bullets. To make these we need a mold, and as the short-range bullet mold is the easiest to make, it would be best to try that first and then work up to the long-range mold. For the pattern use factory-made bullets. Three or four of them, drawn from factory-loaded cartridges, will be enough, and they can be replaced after using. The flask is made of a small box (cardboard will do) about 3 x 2 x 1 inches. Fill it to within ¼ inch of the top with plaster of Paris having the consistency of syrup, and allow it to stand until it is as stiff as putty, then at distances of about an inch stick in the pattern bullets as shown in the illustration. The depth to which the bullets are pressed in the mold will regulate the weight of the cast bullet, so in this way any balls of any weight can be made.

When the plaster is perfectly hard give each bullet a slight tap, turn the mold over, and tap the bottom. This will loosen the bullets so that they can easily be lifted out.

Before pouring in the metal, heat the mold slightly. Even after doing this the first few may be imperfect, but once the mold is heated up they will come out all right. A dipper for pouring the metal can be made from the top of a baking powder can by bending the edge to form a spout and riveting on a handle.

The bullets may require the use of a patch to make them fit snugly in the shell and take the rifling. Thin wrapping paper can be used for the patches, as shown in Fig. 4.

Pure vaseline with enough paraffine to harden it is a good lubricant; it should be put on hot, and will do for inside or outside lubrication.

The short-range mold is made in one piece. The long-range mold, on the other hand, is made in two pieces, each of which receives the impression of half the bullet just as in factory-made tools. The mold is made as follows: Take a small box, a .22 cartridge box will do, and half fill it with plaster of Paris, as in the short-range mold. When it is as stiff as putty, lay the pattern bullet on its side, and press it in until half of it is covered, as shown in Fig. 5. When the plaster is hard, grease its surface thinly with vaseline, so that the two halves of the mold will not stick together. Then pour in enough plaster to fill the box, and when it is hard tear away the pasteboard, separate the two halves with a knife blade, and remove the pattern bullet. Cut a channel through which to pour the lead, and the mold is finished. When using, fasten the two parts together with a string or in any other convenient way.

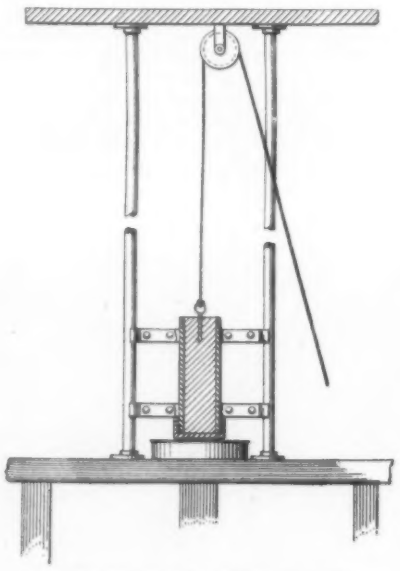
Resizers are usually furnished with reloading tools, but if the cartridges are to be used in the same rifle, they will not be found necessary.

DROP HAMMER FOR SMALL SHOPS.

BY J. A. BERGSTROM.

The accompanying drawings show how a very efficient drop hammer can be made. The drop hammer consists of two vertical rods, with a movable hammer, to which are fastened suitable guides bearing on the rods.

Two pieces of ordinary black iron pipe are secured, and threaded at each end. These pipes should be

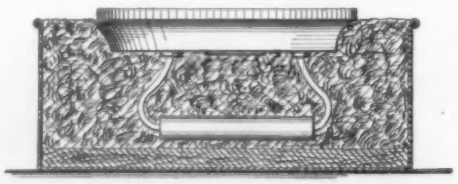


DROP HAMMER OF SIMPLE DESIGN.

made perfectly straight. This is best done by boring a hole in a 3 x 4-inch wooden sill, and fastening it in a vise or in any convenient manner. The pipe is now inserted and bent until perfectly straight. The object of using a block of wood for the straightening is, that it does not mar or deface the pipe.

An ordinary floor flange is now screwed on each end of the pipes, which are then ready to be fastened to the work bench and the ceiling of the workshop.

The hammer proper is made from an ordinary piece of two or three-inch pipe, about 12 inches long, with a cap screwed on one end. The pipe and cap are



CONSTRUCTION OF THE ANVIL.

filled with lead or other metal that melts at a convenient temperature. In the center of this pipe an eyebolt is inserted, and of course will be held there securely, when the melted lead cools off.

Two bands of heavy band iron are now made and formed, so as to fit around the large pipe and partly around the uprights. These bands are made in pairs and fastened together with bolts. By referring to the cross sectional view it will be seen that the outer ends of these bands form guides for the hammer, and allow it to slide up and down vertically. Directly above the hammer is a small pulley, over which a cord runs, one end of which is fastened to the eyebolt in the hammer; the other end may be seized by the operator when manipulating the hammer.

Any suitable block of iron or the like will answer for an anvil; of course, the larger the better. A very

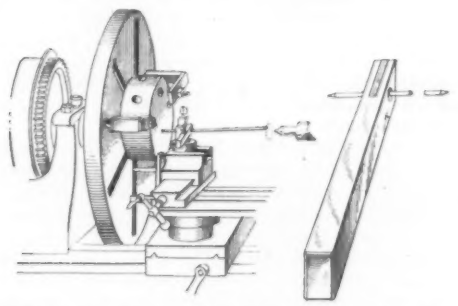
CROSS-SECTION THROUGH THE HAMMER.

good, yet simple, way to make this anvil, which will prove nearly noiseless, is shown in one of the drawings. Into the bottom of a small galvanized iron pan is placed a disk of hard wood about ⅞ inch thick. The pan is then partly filled with cast iron turnings and in this a sad iron is placed in an inverted position. The pan is now filled up and packed with turnings, and is ready for use. As the turnings settle, more should be added in the pan. After a while the whole becomes very solid, yet in a degree elastic, and has a tendency to deaden the sound.

In operating the hammer, it is only necessary to pull on the free end of the cord, which raises the hammer, and when the cord is released quickly, the hammer will drop with great force. The force of the blow may of course be regulated by the height of the drop.

A "WIGGLER" OR TELLTALE FOR CENTERING WORK.

In clamping a heavy piece of work on the face plate of an engine lathe, when it is quite important to have the hole perfectly centered, a "wiggler," such as illustrated herewith, may be used. The wiggler holder is placed in the tool post, with one point of the small rod placed in the center mark of the work. If the work is out of center, the opposite end of wiggler will quickly demonstrate the fact,

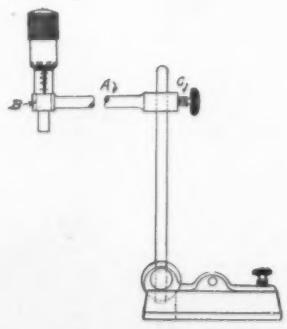


WIGGLER FOR CENTERING WORK IN A LATHE.

showing in what direction the work must be moved. This form of wiggler was devised by Mr. George Clark. It is a piece of steel with a slot milled out or cut in one end and with about a 3/16 inch hole drilled in the end of the steel at right angles to the groove. Now a piece of leather is forced into the groove, and the rod passes snugly through a hole in the leather. This will allow the rod to wobble easily without any lost motion. The expense of this device is about one-eighth of those on the market.

A MICROMETER SURFACE GAGE.

The accompanying drawing shows a micrometer attachment for a surface gage. This tool has been found very handy for leveling up work on milling machines, planers, surface grinders, and various other kinds of machines. This tool is simple in its construction. The end of the micrometer barrel is turned



MICROMETER SURFACE GAGE.

to a neat driving fit and is forced into the arm *A*, which is made of tool steel. This is shown at *B*. The thumbscrew *C* is used for locking the arm *A*, when adjusted at various heights. After the arm *A* has been adjusted to suit a job, the micrometer is used for closer adjustment.

HACK-SAW ATTACHMENT FOR LATHES.

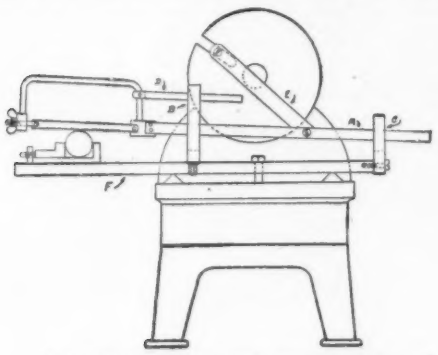
BY H. D. CHAPMAN.

The accompanying drawing shows the way in which a hack-saw can be attached to a lathe. This will be found very handy about a small shop, and is inexpensive and simple in its construction. The device is so constructed that it can be easily put on and taken off the lathe.

The saw and its parts are mounted on a 1-inch thick by 8-inch wide cast iron slab; this makes the device easy to use on any lathe. The device consists of slide bar *A*, and two supports on each end, *B* and *C*, which are to guide the bar *A*; the bar *D* is to brace the saw frame and to keep it from turning.

The slide is a flat piece of machine steel 5/16 inch thick and 2 inches wide; the length is about 4 feet, or to suit the stroke. A hole is drilled in the slide bar *A* for a 5/16-inch bolt. This is to hold the connecting rod *E*.

The supports *B* and *C* are made of 1-inch square stock. The support *B* has an end turned and threaded to suit a ¾-inch tapped hole which is in the cast iron



HACK-SAW ATTACHMENT FOR LATHES.

base *F*. The support *C* is bolted to the other end of base, as shown. Each support has a 5/16-inch slot cut through the center, so as to allow a neat sliding fit to slide bar *A*.

The guide *D* is made of 5/16-inch by 1-inch machine steel. One end of guide is bolted to saw frame, allowing the other end to slide through support *B*, thus preventing the saw from having any wabble.

The connecting rod *E* is a strip of 5/16-inch flat steel about 2 inches wide and of a length to suit the saw frame. The connecting rod is also bolted to the face plate of the lathe, as shown in the cut, and can be adjusted in the slot of the face plate; this adjustment will accommodate the length of the saw.

The saw frame is made of machine steel, and the saw is made tight in the frame by means of a thumbscrew, as shown at the outer end of the frame.

An ordinary machine vise is clamped to the base plate; this holds the stock while cutting off. This hack-saw fixture is clamped to the shears of the lathe, as shown, and is held in position with a ¾-inch bolt.

AS TO BORING HOLES IN WOOD.

BY W. D. GRAVES.

Men there are who claim that they can bore holes absolutely true as to direction; but most of us know that *we* cannot do so. Those of us who have had much experience with hand tools can, by taking care, bore accurately enough for ordinary practical purposes; but, if we have many similar holes to make, time may be saved and accuracy assured by borrowing an idea from the machinists, and using a jig.

To make this, take a block of wood and bore a hole through it as nearly as may be at the desired angle; then, working from the hole, true up the face till the angle is correct. Tacking or clamping this jig to the work gives one a sure and reliable guide whereby to start the bit. Fig. 1 shows such a jig, gotten out to

Fig. 1.—JIG FOR BORING AT AN ANGLE.

bore at an angle of 45 degrees. The hole for the bit to follow is shown by the dotted lines; and the notches *C* and *D* make it of convenient form to clamp to the work. In boring at such an angle some device of this sort is almost indispensable, and affords a marked saving of time; as the tendency of the bit to "crawl" along the grain of the wood is otherwise difficult of prevention.

A jig may be of use in accurately spacing holes, by having a dowel pin, as shown at *G* in Fig. 2, to engage in each preceding hole as one goes along. Also, where holes are to be bored similarly in a number of uniform pieces, the outside of the jig may be so shaped as to form a guide for their location; thus saving an amount of measuring and marking.

A somewhat difficult job, which woodworkers are often called upon to do, is to bore a hole accurately lengthwise of a block. One undertaking such a job usually bores from both ends, making the holes meet in the center—sometimes. A guide, such as is shown in side and end views in Fig. 3, tends to accuracy in

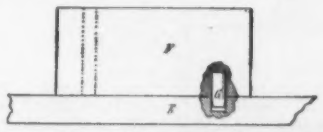


Fig. 2.—JIG FOR SPACING HOLES UNIFORMLY.

such cases. Strike a line along the side of the piece to be bored, parallel with the desired direction of the hole, and secure the straight edge of the strip *I* against that line; allowing it to project beyond the end of the block two or three inches less than the length of the bit. Secure to the end of this strip, at a right angle therewith, the piece *J*. At the point in this

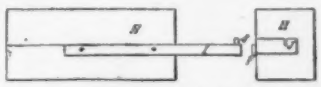


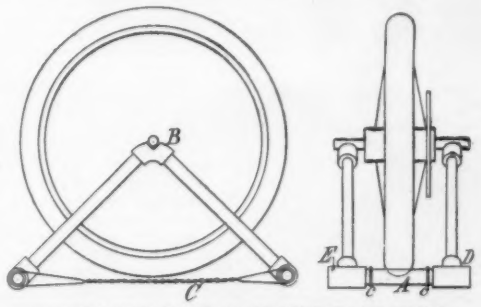
Fig. 3.—JIG FOR BORING A STRAIGHT HOLE.

piece which would be the center of the hole, were it extended, bore a hole to fit the shank of the bit to be used, and notch out as shown. Rest the bit, then, in this notch till it is well started; and a hole true to direction will be assured.

SIMPLE MOTOR-CYCLE STAND.

BY ROBERT H. BROCKMAN.

A stand for motor-cycles can be made very simply out of pipe fittings, as shown in the accompanying sketch. The pipe used may be ⅜ or ½-inch pipe, but the latter is preferable because it makes a stronger stand. The drawing needs little explanation. The piece of pipe *A* must have a running thread cut on one end, so that it can be screwed into the tee *D* about



MOTOR-CYCLE STAND MADE OF PIPE FITTINGS.

an inch and a quarter; and then when the stand is ready to be put together, the pipe *A* may be screwed back into the tee *E*, leaving enough in the tee *D* to provide a good hold. To keep the stand from spreading and thus to relieve the strain on the elbows *B*, two pieces *C* of No. 12 galvanized wire should be used to connect the pipes *A*. In the elbows *B*, notches may be cut to hold the motor-cycle axle.

SERVICEABLE SCREW-THREAD CORRECTOR.

BY H. H. F. CLARKE.

When dealing with the hubs of bicycles, or any threads that are subject to much knocking about, it is often found difficult or even impossible to get the nut to run freely.

A good way of remedying this is to obtain a new hexagonal nut of the right size (it must be made of steel; wrought or cast iron ones will not do), soften it and cut a V-shaped slot on the inside running across and a little deeper than the threads. This slot must be cut very carefully with a fine, triangular file, so that no burrs adhere to the edges. Now re-temper to the proper degree of hardness of cutting tools, and the tool is ready for use.

DEVICE FOR CORRECTING DAMAGED SCREW THREADS.

Screw this nut backward and forward on the worn thread, and it will be found that the threads are toned up and straightened, without any apparent injury to the nut, enabling the original nut to run on easily.

Several of these handy little tools should be made, varying in size. They take the place of the expensive stocks and dies and do the work just as well. If kept always at hand, they will be found invaluable when dealing with small repairs.

SCROLL SAW HINTS.

BY W. AND K. PARKHURST.

MAKING PARALLEL CUTS.

It is frequently necessary when using a scroll saw to cut strips of wood, either curved or straight, with their opposite edges absolutely parallel. Of course, the ordinary method would be to follow plotted lines, but the scheme illustrated herewith is much simpler. It consists in using two saws which are adjustable laterally to cut any width of strip, and saw both edges of the strip at the same time. In Fig. 1 is a plan

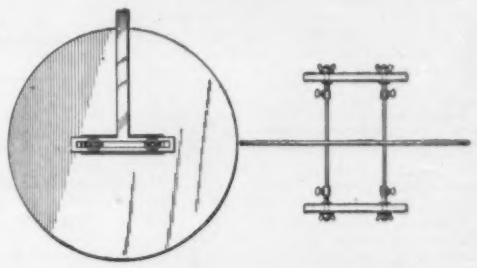


Fig. 1.—SCROLL SAW ARRANGED FOR MAKING PARALLEL CUTS.

and a side view of the device, showing the upper saw arm, which is formed with a cross piece. A slot is cut in the cross piece to receive the saw-blade fastenings. The opening in the saw plate is enlarged to receive the two saws. The side view shows the cross piece on the upper and lower arms, and the two saw blades secured therein. The saw blades are adjustable in the slots in the two cross pieces, and may be securely clamped to any position by tightening up the wing nuts. If desired, more saw blades can be added to permit of making more than two cuts simultaneously.

CUTTING A BEVEL EDGE.

It is probable that many amateurs do not know that beveling can succesfully be performed with a scroll saw. No special apparatus is required, except for a wooden strip about three inches wide and five or six inches long, attached to the scroll saw table. Two holes are drilled in the table or saw plate to receive a pair of 3/16-inch bolts provided with wing nuts, whereby the board may be attached

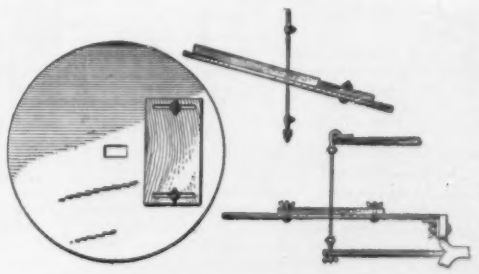


Fig. 2.—SCROLL SAW ARRANGED FOR CUTTING A BEVEL EDGE.

to the plate. The board is provided with slots through which the bolts pass, so that it may be adjusted relatively to the saw. It then serves as a guide for the strip to be cut. Of course, the edge of the article to be beveled should be held close to the guide, so that an accurate bevel may be made. The angle of the bevel is determined by the angle of the saw plate, which may be adjusted after loosening the bolt found back of the plate. It will be necesary to increase the size of the saw opening in the plate if a very flat bevel is to be cut in the strip.

Shop Notes.

When sawing across the grain in very hard wood, like lignum-vitæ, thoroughly seasoned oak, or hickory that is very hard, the ordinary rip saw will cut very much faster and better than the cross-cut saw, which is the only thing that will work satisfactorily on the soft woods.

A wood turner in using a wooden chuck in the lathe rubs on common chalk, which helps to hold the work from slipping or twisting in the chuck.

When driving screws into wood with a screw-driver, it is quite an advantage to use soap on the thread of the screw. Simply draw the screw across the bar of soap before inserting.

To tin a soldering copper, heat it to a fairly good heat and clean the point to be tinned with a file. A brick is as good as anything to rub the point on, as it stays in place, and it can easily be scooped out a little to hold the solder and rosin. To make a success in tinning the point, it is important to have the right heat in the copper, just enough to melt the solder fairly easily. Too much heat will cause a failure, as it burns the rosin and blackens the points.

RECENTLY PATENTED INVENTIONS.

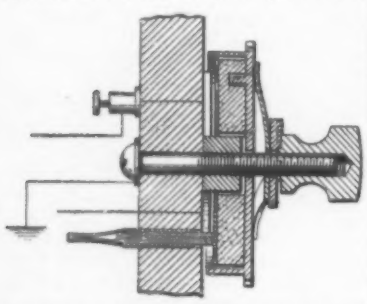
Pertaining to Apparel.

HOSE-SUPPORTER.—L. H. Zeigler, Redkey, Ind. The supporter is particularly adapted for use with the half-hose worn by men. The inventor's object is to produce a device which is simple of construction, and which is formed in such a way that it will be very light and flexible and adapted to be secured in position without restricting the circulation in the limb.

GARMENT-SUPPORTER.—J. Zelman, El Paso, Texas. This supporter comprises a strap which may be of webbing or other suitable material and may have an adjusting slide of any style and the clasps are secured by their loops to the opposite ends of the strap so they may be clamped, one to the tape on the garment and the other to the hose.

Electrical Devices.

AUTOMATIC ATTACHMENT FOR CLEANING ROUND CARBON OR METAL LIGHTNING-ARRESTERS.—William S. Hale, Buckley, Ill. The cleaner shown in the engraving is automatically operated. The receiver hook, every time it is forced down, operates a lever which is pivotally secured to



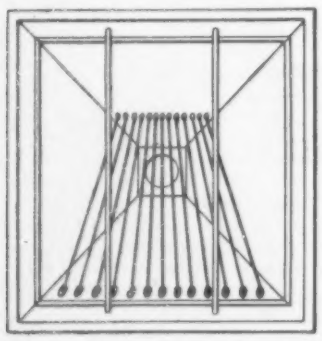
ATTACHMENT FOR CLEANING ROUND CARBON OR METAL LIGHTNING-ARRESTERS.

the binding-post, and thus, by means of the pawl, advances the cap and the disk a part of a revolution, wiping the face of the mica sheet and the terminal-disk over the brush, which cleans off any particles which may have accumulated thereon, thus preventing a permanent short-circuit between the line-wire and the ground-wire being formed.

PROTECTOR FOR HARVESTERS.—J. J. Graham, Sheyenne, N. D. This invention is an improvement in protectors for harvesters. It may be applied to any apparatus of this kind with no change except the boring of a few holes. The protector will prevent straws, gum, etc., from collecting on the rollers and clogging them, especially the lower roller of the elevator apron.

Of General Interest.

MUSICAL HORN.—George H. White, 715 North Pine Avenue, Austin Station, Chicago, Ill. The horn illustrated herewith is for use on phonographs, megaphones, and the like. The device amplifies the original sounds by means of the vibrating strings which are car-



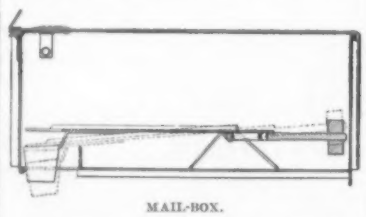
MUSICAL HORN FOR PHONOGRAPHS, ETC.

ried within the horn, and which take up the vibrations of the original sound, thus producing a clearer and stronger tone. The means provided regulate the pitch, and break up objectionable echoes that produce those conflicting sound waves which impair the ordinary device.

TRAP.—J. R. Schuyler, Bloomsburg, Pa. This trap is provided with a standard pivoted to the base, with means by which it may be readily held in an upright, operative position, a trip, which is pivoted to the standard, being disposed to engage the trigger, the trip being adapted to hold back, in operative position, a spring arm which is mounted on the base.

OPTOMETER.—H. D. Reese, Abbeville, S. C., and A. J. Glaxon, New York, N. Y. The aim of the invention is to provide a device of the nature as that disclosed in a prior patent granted to Mr. Reese, but which has certain improvements over the latter. In the improved means for the examination of eyes and for testing the eye-sight a mirror is provided which may be moved by means of a handle so as to throw the light needed into the desired position, which is an especially desirable feature of the apparatus.

MAIL-BOX.—Harry E. Carmony, R. F. D., No. 1, Box 62, Shelbyville, Ind. The insertion of mail into the box will work a signal automatically. The device may be easily applied to existing and opening boxes, merely by forming a slot, and inserting a plate. The construction is otherwise the same. The

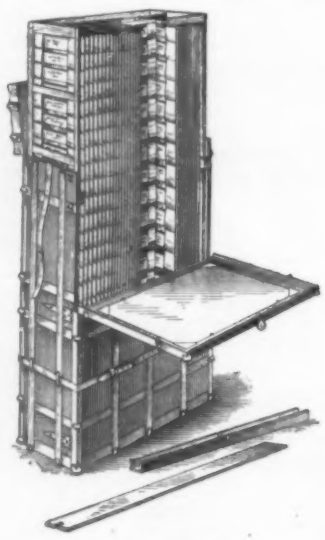


MAIL-BOX.

bracket for supporting the false bottom is merely laid in place, it being of suitable length and width to prevent dislocation of the bracket. The improvement is applicable to boxes of any kind. It is, however, best suited for use with the form of box shown in the engraving.

DRY SEPARATOR.—A. W. Ringland, McAlester, Okla. In this case the invention pertains to separators for use in placer mining, and the purpose is the provision of a dry separator, arranged to insure a thorough separation of the gold from the sand or other extraneous matter in a very simple and effective manner.

FILING-CABINET.—James B. Potter, 59 Wall Street, New York, N. Y. In the cabinet shown herewith, the documents filed therein may be closely packed and securely held in position. The filing devices are constructed so that they conform to a system whereby



FILING CABINET.

documents may be placed topically, the devices being adapted to be freely and readily removed from the cabinet for transportation. For this service the cabinet is made and arranged in trunk form. The view given shows its adaptability for use as a temporary desk.

FINGER-SUPPORT FOR MANICURISTS.—J. Macdonald, New York, N. Y. Here the inventor has in view a support arranged to present the finger nail in a firm and convenient position to be worked on, the implement having a base to insure stability, with a handhold intermediate the base and support, the base being free to slide about so that the hand with the support can be moved to desired position.

LARD-CUTTER.—J. Harmison and H. P. Harmison, Romney, W. Va. This cutter is designed for use in cutting and weighing lard or similar substances in bulk. When the barrel is forced down into a body of lard, it will fill the former up to the plunger and the barrel may be given a half turn to cause the cutter to operate. The barrel with its weight of lard may then be withdrawn from the mass, the gage plate released, and the plunger pushed down to discharge the lard from the barrel.

ANIMAL-TRAP.—J. Hollenback, Boise, Idaho. In this patent the inventor's aim is the provision of novel details of construction for a trap which render the contrivance very reliable, and adapt it to grasp and to hold large or small animals with equal certainty upon an attempt being made by an animal to walk or crawl over the "set" trap.

CHARGING-CAPSULE FOR SIPHONS.—D. Brescia, Quito, Ecuador. The capsule is adapted for attachment to the outlet tube of a siphon receptable, and adapted to be charged with liquid carbonic acid gas or gas of similar character, the capsule when charged being automatically sealed, and automatically opened when applied to a siphon, at which time the gas in the capsule is permitted to mingle with the liquid in the siphon and thus charge the liquid.

Hardware and Tools.

NUT-LOCK.—I. Shafer, San Diego, Cal. The improvement is in nut locks, and the object of the invention is to provide a device that may be cheaply made, easily applied, and that will firmly lock the nut in place, and which will be fixed in place by the turning of the nut. The essential feature of the invention is the laterally bent tongues for gripping the bolt and the opening of smaller size than the bolt.

SAW-HANDLE.—B. B. Stepp, Caryville, Tenn. The main object of this improvement is to provide a handle which can be instantly removed, thereby enabling the wood cutter to save a saw from being broken, which otherwise he could not save. The handle may be readily applied to a saw and may be as rigidly secured thereto as if it were permanently secured to the saw.

Household Utilities.

METALLIC WATER-CLOSET SEAT AND COVER.—F. A. Stephan, New York, N. Y. For the purposes of providing a seat and cover not liable to crack or to warp, they are both formed of a sheet metal, the body of the seat being in the form of a flat annulus having its edges bent downward, and the cover being in the form of a disk having its edge turned down, both the seat and cover being rendered strong on account of the turned down edges.

GAS OR VAPOR STOVE.—A. E. Hartig and E. B. Wooten, Davenport, Iowa. This invention has in view a stove in which the heat is advantageously distributed, reducing the consumption of gas without impairing the baking or roasting qualities, also admitting of the cooking being carried on at the top of the stove either by the heat of the oven or in the usual manner by independent burners.

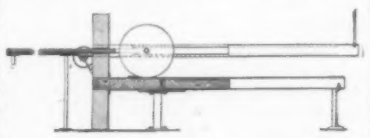
BED AND DOUCHE PAN.—J. E. Gavin, New York, N. Y. One object of the inventor is to provide a device with a receptacle and a removable pneumatic cushion of a new and improved type. It can be used as bed pan or douche pan, and when used as the former, by reason of its slope can be readily inserted beneath a bedridden patient without any great discomfort to the latter. The yielding cushion forms a very comfortable, easy support for the body. It is readily accessible for cleansing.

COOKER.—G. W. Ferguson, Sheboygan, Wis. This invention relates to cookers, the more particular purpose being to form a device for use as a fireless cooker to which heat is constantly supplied until the operation is completed. The cooker, when used with or without heat being constantly supplied to it, employs steam, and this steam cannot burst the apparatus or any part of it.

TOASTER, HEATER, AND WARMER.—F. G. Dupell, New York, N. Y. The invention has in view a device for gas or vapor stoves, embodying a heating chamber and a perforated cover foldable or otherwise movable over the top wall of the chamber to provide a toaster, the heating chamber being seated on top of the stove and having a series of flues passing therethrough over each burner, the vessels to be heated being ordinarily seated over the flues under which a burner is lighted, and an article to be warmed supported on the heating chamber at a point removed from the lighted burner.

Machines and Mechanical Devices.

METAL-JOINER.—John Smith, 591 Shepard Avenue, Brooklyn, N. Y. The engraving of the joiner represents a device adapted to join the fold-over edges of two sheets of metal by means of the heavy roller. The traveling member joins the folded edges of two sheets



METAL JOINER.

of metal, the travel whereof being automatically stopped when the traveling member reaches the end of its stroke. The metal joiner is provided with a reversible die bed having different sized grooves in each face, whereby different sizes of joints may be made.

TANK-VALVE.—W. N. Long, Eugene, Ore. This invention provides a casing to protect the operating parts of the valve and to guide the last in its operation; trap refilling may be carried forward after completion of flushing operation; chattering, vibration, or sound of the rushing of water is avoided; and the containing chamber wherein the pressure on the valve parts is equaled, permits the valve to work quietly under high pressure.

AEROPLANE FLYING-MACHINE.—J. M. Biggs, Dayton, Ohio. An object here is to provide an aeroplane of symmetrical and pleasing appearance in which the framework is made of a shape to give the greatest strength and rigidity, with two wing-like planes attached to the edges and the third forming a canopy above it.

PHOTOGRAPHIC-PRINTING MACHINE.—P. R. Johnson, Fairdale, N. D. The negative is disposed in a plate holder and held in place behind the shutter. A tympan operable by a treadle holds the printing paper and moves it into position against the negative, and means are provided by which the tympan operates the shutter as the paper is pressed against the negative by the tympan. Means are also provided for holding the paper in place when the paper on the tympan is pressed against the negative.

GRADER.—J. W. Beasley, Modesto, Cal. The invention plows the dirt and delivers it to an elevator and distributer; delivers the dirt at each side of the machine alternately, so that it may be distributed or received in a conveyer for removal; its receiving drum guides the delivery belts and forms a driving member therefor and delivers the dirt from the interior of the drum upon the belts; and provides the manually operated controls for the operating mechanism.

Prime Movers and Their Accessories.

ROTARY ENGINE.—C. R. Ord, McAdam Junction, New Brunswick, Canada. In this patent the improvement is of a character embodying a number of cylinders arranged on a shaft approximately parallel thereto, the cylinders each having pistons projecting from its opposite ends and acting on relatively inclined or cam surfaces.

Railways and Their Accessories.

TRACK-RAIL BOND FOR RAILWAYS.—C. A. Parker, Fort Fred Steele, Wyo. The purpose of Mr. Parker's invention is to provide a novel track rail bond for railways, which is extremely simple, readily applied, compensates for the expansion and contraction of track rails and fish plates that connect said rails at their joints, and maintains ample electrical conductivity under all conditions of service.

TIE-PLATE.—L. Lebovitz, Sedalia, Mo. The invention has in view such an appliance as forms a seat for the rail and engages over the base flanges, the plate extending down at each side of the tie and the under side thereof, and increasing the tie for a portion of its length under the rail, the plate being preferably constructed of two sections, the last divided from each other longitudinally of the rail at the top and transversely of the rail at the bottom.

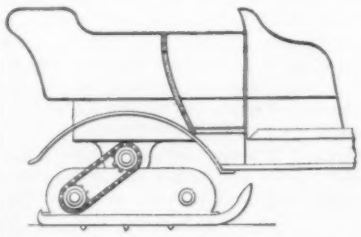
BUFFER FOR AUTOMATIC COUPLINGS FOR RAILWAY AND STREET CARS.—L. Boirault, 20 Rue Laffite, Paris, France. This invention relates to a device designed to be secured on a drawhead and which allows of a car provided with the head being coupled with a car provided with a central buffer instead of a similar head. The invention relates to improvements in automatic couplings shown in a previous U. S. patent granted to Mr. Boirault.

Pertaining to Recreation.

TOY.—J. Vanderbilt, New York, N. Y. It is sought in this instance to provide a floating body or balloon, and a medium in which it can float, together with a basket carried by the balloon and provided with means for receiving a small weight when the balloon is in its uppermost position and for causing the release of the weight when the balloon is in its lowermost position.

Pertaining to Vehicles.

TRACTION DEVICE FOR MOTOR-VEHICLES.—Truman J. Andrews, Bemidji, Minn. The device shown in the illustration of this patent is useful for motor vehicles, but particularly so in connection with motor sleighs. It includes an endless traction member ar-



TRACTION DEVICE FOR MOTOR VEHICLES.

ranged to be continuously driven by the motor of the sleigh and having spurs adapted to engage the ground to give the necessary traction, the spurs being movable transversely of the endless member whereby they adjust themselves to the nature of the ground over which the vehicle travels.

Designs.

DESIGN FOR LEATHER.—S. D. Brightman, New York, N. Y. This ornamental design for the surface of leather shows nearly triangle shaped forms an eighth of an inch long about that distance apart pointing one way, and between these are hair-like lines averaging four to the inch in length, the rest of the surface being freely stippled with small dots.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12285) F. J. S. says: I would be very thankful to you, if you would kindly let me know through the SCIENTIFIC AMERICAN when connecting electric lights in series on a 110-volt circuit whether each one consumes an additional amount of amperage? For example, the lights you buy for this purpose are usually about 14 volts and ¾ ampere. Will each one consume ¾ for itself, or will the entire eight consume that current together? A. If lamps are connected in series upon a 110-volt circuit, the same current flows through the entire series. Thus if eight lamps of 14 volts each are in series, and the lamps use ¾ ampere each, the entire series consumes ¾ ampere at 110 volts. You could not put a single 14-volt lamp on a 110-volt circuit. It would be burnt out like a flash of gunpowder.

(12286) W. C. says: In rubbing two metals together, the metals become heated. What I would like to know is, what two metals or compositions of metals will generate the most heat by friction? A. Rubbing two articles together converts into heat the mechanical work done in moving the objects. It makes no difference what the materials are. If they are pressed together with sufficient force to require 1 horse-power to move them at some stated velocity, any two plates of any one or of two different materials will convert the work into 33,000/778 or nearly 45 British thermal units, enough to heat 45 pounds of water 1 deg. Fahrenheit per minute. If you use polished steel plates, oiled, you must apply more pressure than with rough iron plates, run dry; but given enough pressure to cause the plates to resist turning to the extent of using 1 horse-power to move them at a given speed, all materials will develop 45 B.T.U. per minute.

(12287) H. M. S. says: Please give me the formula for finding the horse-power of a simple and a compound steam engine, and also the speed or R.P.M. A. The general formula is $\frac{PLAN}{33{,}000}$, a combination of letters easy to keep in mind. *P* stands for the mean effective pressure on the piston, that is, the average steam pressure per square inch pushing the piston less the average exhaust or back pressure resisting its motion. *L* is the length of stroke in feet. *A* is the area of the piston in square inches less one-half the area of the piston rod. *N* is the number of strokes per minute. The product $P \times L \times A \times N$ is therefore the total pressure pushing the piston multiplied by the total feet per minute which the piston travels, and this product is therefore the foot-pounds of work done on the piston; and divided by the number of foot-pounds in 1 horse-power, or 33,000, the quotient is the horse-power developed in the engine cylinder. With two or more cylinders, whether the engine is compound or merely duplex, tryplex, etc., the formula is used to calculate the inducted horse-power of each cylinder separately, and these are added together to give the total horse-power of the engine. SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 253 and 992, 1710, and 1746 contain articles on the subject of determining the horse-power of steam engines, and there is no other way in which so much information can be obtained at so small a cost as by purchasing these numbers at the regular price, 10 cents each. Complete information on this and all other practical questions of steam engineering is found in useful form in Roper's "Engineer's Handy Book," 844 pp. leather flap binding for the pocket, price $3.50. We shall be pleased to send you SUPPLEMENTS or book upon receipt of the price.

(12288) A. C. H. says: I am in the screen business, and this matter comes up for discussion very frequently. The architects in this locality firmly believe that rooms are best ventilated by opening windows at the top; while I have always contended that the breath exhaled from the lungs is mainly carbon dioxide, which is heavier than air, and falls to the floor, and for that reason proper ventilation is best secured by raising all windows from the bottom. A. Impure air exhaled in breathing rises at first and settles afterward, diffusing itself through the surrounding air. It is best gotten rid of at the top of the room. It rises because it is warmer than the surrounding air. This may be seen by watching the air exhaled by a smoker, the smoke in his breath being much heavier than the air. The air exhaled from the lungs is not mainly carbon dioxide, but contains only a small percentage of that gas, about four per cent, and thus is mainly air at a temperature of 98 deg. F., much warmer than the air of the room, and therefore lighter.

(12289) H. H. G. says: Will you kindly tell me the lifting power of a 4-foot aeronautical propeller, 4-foot pitch, with two 7-inch blades, running in a horizontal plane, 700 r.p.m., also 1,050 r.p.m.? How many horse-power are required? A. Propellers have very little direct lifting power compared with their pulling power when they are in motion through stationary air. Your propeller has a circular area of 12½ square feet, and at 4-foot pitch and 700 r.p.m. would move a body of 35,000 cubic feet of air per minute through a distance of 2,800 feet per minute, supposing perfect efficiency. The weight of this air is about 2,800 pounds, and the force exerted by the propeller is found by dividing this weight by the acceleration due to gravity in feet per minute, or 32.2 x 60, which gives 420 pounds lifting power. But the efficiency of the propeller will be probably about 30 to 40 per cent at most, so that the lifting power will be reduced to 120—160 pounds only. At 1,050 r.p.m. these figures would be increased to from 180 to 240 pounds. You must remember that this is approximate only, and that while these figures are maximum, the blade shapes may easily be inefficient to the extent of reducing the calculated figures very greatly. The horse-power required is likely to be 30 to 50, according to speed.

NEW BOOKS, ETC.

ELECTRIC MOTORS. Their Action, Control, and Application. By Francis B. Crocker, E.M., Ph.D., and Morton Arendt, E.E. New York: D. Van Nostrand Company, 1910. 8vo.; 291 pp. Price, $2.50 net.

The general method herein adopted is an outgrowth of the course of lectures on electric motors and their applications given in Columbia University. It is based upon the consideration of counter E. M. F. and its relations to impressed E. M. F. as the important criterion of motor action. This point of view is, of course, not original, but it is claimed that the conception is more explicitly and widely applied than heretofore. Furthermore, this idea brings together the motor and generator so that they may be regarded as identical except for slight differences easily seen, and our knowledge concerning one is applicable to the other. The plan of treatment also links voltage with speed, and current with torque, since in general they are respectively proportional. Thus we consider one pair of quantities at a time instead of four. The synchronous A. C. motor differs so radically from the D. C. type that the treatment must be modified, but even in this case a similar standpoint is adopted as closely as possible.

THE PHOTOGRAPHIC ANNUAL, 1910-1911. Edited by E. J. Wall, F.R.P.S. London: Dawborn & Ward. New York: Tennant & Ward. 12mo.; 287 pp. Price, 50 cents.

In preparing the subject-matter for the Photographic Annual for 1910 it soon became evident that to include a complete summary of the two principal topics of interest of the past twelve months, namely, Screen-plate Photography and Development, would have necessitated a much greater increase in the size of the volume than was advisable. It was felt, therefore, that the best way out of the difficulty was to present these subjects in the form of complete articles, and to excise some of the formulæ which had either become obsolete or of less importance. In such a task the difficulty has been to decide what should be left in, and the standard set was to retain, as far as possible, those formulæ which would be required by the average worker in everyday practice.

HANDBUCH FUER HEER UND FLOTTE. Enzyklopaedie der Kriegswissenschaften und verwandter Gebiete. Unter Mitwirkung von zachlreichen Offizieren, Sanitaetsoffizieren, Beamten, Gelehrten, Technikern, Kuenstlern u. s. w. herausgegeben von Georg von Alten, Generalleutnant Z. D. Mit zahlreichen schwarzen und farbigen Tafeln, Tabellen, Karten, Planen und Textillustrationen. Berlin, Deutsches Verlagshaus Bong & Co. Instalments 22, 23, and 24.

The last three instalments of this admirable encyclopedia of the army and navy takes us from "Carnuntum" to "Dampfmaschine." The articles have all been written with the same painstaking care that characterizes the contributions to previous instalments. Particularly noteworthy in the numbers that lie before us are the contributions on "Cartagena," "Julius Cæsar," "Charleston" (and the part which it played during the civil war), "Cherbourg," "China," "Conde," "Steam Boilers," and the "Steam Engine."

SEWERAGE. The Designing, Construction, and Maintenance of Sewerage Systems. By A. Prescott Folwell. New York: John Wiley & Sons, 1910. 8vo.; 506 pp. Price, $3.

During the past ten years this work has been recognized as the standard on sewer designing and construction and has been used as a text book in most of the engineering schools. The first edition did not pretend to deal at all with the subject of sewage treatment, but in response to numerous requests from professors who had adopted it for their classes this subject was treated in outline in the later editions. In the sixth edition, just published, the principles of sewage disposal are expounded quite fully, including the very latest theories and ideas which have received the recognition of experts; these including the main features of construction, as well as the theories involved in purification. The subject has been entirely rewritten and greatly enlarged from previous editions. Several other portions of the work have been more or less revised to bring them up to date, and considerable new matter has been added, especially in designing and construction methods and in specifications with reference to the use of concrete in sewers and their appurtenances.

MECHANICAL DRAWING. An Elementary Text Book. By John E. Jagger, M.Sc. London: Charles Griffin & Co. Philadelphia: J. B. Lippincott Company. Small quarto; 251 pp. Price, $3.50.

The object of this book is to provide notes, observations, and examples, by the careful perusal of which it is hoped that a student may be able to acquire the ability, first, to read a drawing with rapidity and accuracy; second, to make a simple drawing so that any ordinary workman can understand what is required without difficulty, loss of time, or tendency to make a mistake; third, to make use of the experience obtained by studying the examples in any future mechanical construction he may undertake. This book is exactly the type of book which is required. There is a judicious combination of line and halftone cuts which show what the finished object looks like. This idea is a good one and is, so far as we know, new. The line cuts are reproduced on a liberal scale, and it does not require any trying examination with a magnifying glass. There are also specimens of white prints, blue prints, tracings, etc. On the whole the book is the most practical one we have seen in a long time, notwithstanding it has been our privilege to review probably a score within a year.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were issued for the Week Ending

September 6, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrading machine, J. M. Nash 969,185
Accumulator, steam regenerative, E. Eckmann 969,257
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Game Farming.

(*Continued from page 212.*)

The weight per head of course is much greater, and the hide much more valuable, so that buffalo farming for the meat and hide ought to prove a highly profitable undertaking.

Second only to the buffalo in importance, in the days when wild game animals were the sole reliance of the pioneers of the West for their supplies of fresh meat, was the elk. Although somewhat smaller than the moose, the elk is more graceful in appearance, so that it is considered the noblest type of the great deer family.

Advocates of Angora goat breeding argue that there are at least 250,000,000 acres of mountainous or desert land, entirely worthless for agriculture, and almost worthless for grazing sheep and cattle, that might be made productive if devoted to the rearing of goats. This contention is doubtless true; but it is true also that a better economic use of these waste lands would be the rearing of buffalo, elk, deer, and other game animals. The elk, in particular, are well able to defend themselves against wolves and coyotes, and their meat is much more profitable than goat meat, which will never be popular in America.

These conditions of an inadequate meat supply and vast areas of unutilized and unproductive lands have led to the suggestion that elk farming and deer farming (and possibly other game farming activities) be taken up, to supplement the ordinary live stock industries. Of course, before game farming can develop into an important industry, there will have to be a material revision of the game laws of nearly all the States, which forbid the killing of elk and deer excepting for a short period in the fall (when the meat is the poorest), and in some cases prohibit the shipping of the carcasses across the State boundaries. Before game farming can become attractive to individuals who might engage therein, or important to the people as a source of meat supply, these laws will have to be amended so that the man who wishes to produce venison or other game meat for market will be permitted to slaughter his live stock and market his product free from all restrictions. It is not at all likely that the slightest objection would be encountered to such amendments to existing laws, if legislators can be shown that there is any prospect that game farming will be undertaken on a scale of any importance. Similar amendments are needed to permit pheasant farmers to kill and sell pheasants reared in confinement, at any time and in any market. It is now well understood that pheasant farming is much more profitable than the rearing of ordinary farm poultry; and the only obstacle in the way of a great development of this industry is found in antiquated game laws that fail to provide for the contingency of game birds being reared in a state of domestication.

In many sections of the West the depredations of wolves and coyotes are so great as to deprive stockmen of the legitimate profits of their industry, in spite of wolf-proof fences, and every effort that can be put forth to destroy the bandits of the ranges by poisoning, hunting, and trapping them. It is stated in publications of the Biological Survey that elk, particularly when in large herds, are perfectly well able to protect themselves and their young from enemies of this kind.

The largest herd of the elk, or wapiti, remaining are in the Yellowstone Park and Jackson's Hole region of Wyoming, estimated to number about 30,000. In addition there are large bands in the more isolated portions of Colorado, Montana, Idaho, British Columbia, and Labrador; and smaller bands in Washington, Oregon, California, and the Dakotas. That elk are well adapted to a state of semi-domestication has been proved by several "elk farmers," and on many game preserves. The largest herd in captivity is owned by Barrett Littlefield, near Slater, Colo. Mr. Littlefield claims that elk farming is more profitable than cattle raising, and ships many carcasses to Denver in season, besides supplying live animals to numerous zoological gardens and parks. J. B. Dawson, of Hayden, Colo., raises elk on a large scale; and the Glen Beulah deer preserve, near Debeque, Colo., is famous for its fine herd of deer and elk. George W. Russ, of Eureka Springs, Ark., has had a herd of elk on his estate for many years; and both deer and elk are reared on private estates and game preserves in New Hampshire, Vermont, Massachusetts, New Jersey, Pennsylvania, North Carolina, Georgia, Texas, Washington, and other States.

The heavy snows of the past two winters indicated in a rather striking manner how peculiarly the elk is adapted to being reared in a state of semi-domestication. Unable to obtain forage in the wilds, on account of the deep, hard-frozen snows, the elk descended upon the farmers' stacks of hay and straw in parts of Colorado and Wyoming, making it necessary that these be guarded night and day, that the owners might save enough for their own live stock. At Jackson's Hole, Wyo., it was necessary for the citizens to raise a fund for the purchase of hay to feed the elk, until the State Legislature appropriated $5,000 for that purpose. But for this timely help it is believed that 20,000 elk would have perished in the winter of 1908-09. At one time 500 elk were counted in the streets of Jackson's Hole, displaying no fear, and accepting rations as a matter of course. The great herds of the Jackson's Hole country may now fairly be considered partially domesticated.

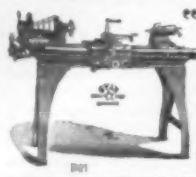
This indicates somewhat the lines along which elk farming might be developed. In mountainous regions, entirely unfit for agriculture or sheep and cattle raising, great bands could forage for themselves, excepting in the severest of winter weather, when it would be necessary to supply them with hay, and profitable to give them shelter. They are more hardy than range cattle, and, with limited winter feeding, the mortality due to the elements could be eliminated, instead of reaching the ruinous proportions common on the cattle ranges. Elk will to a large extent live on leaves and shrubbery that cattle despise, and in the winter will paw several feet of snow from the ground, to gain access to the leaves and grass beneath; but if the snow becomes compact and ice-crusted, large numbers sometimes starve. This limits their natural increase greatly, so that with winter feeding elk would multiply much more rapidly than in a state of nature.

Practically the same conditions would control deer farming, although the deer is less hardy than the elk. In a bulletin of the Department of Agriculture, Dr. C. Hart Merriam said that "deer farming may be made profitable alike to the State and to the individual engaged therein. The raising of venison is as legitimate a business as the growing of beef and mutton." Mr. W. F. Kendrick, president of the American Game Association of Denver, and a pioneer in game farming, states from his own experience that venison and elk meat can be placed on the market at a less cost to the producer than either beef or mutton.

However, it is not only proposed to rear game animals for the sake of their meat, but to rear other species for their furs. Another bulletin of the Biological Survey has this to say: "As civilization encroaches upon the breeding grounds of wild animals, the supply of fur diminishes, and the prices correspondingly advance. If furs as articles of use and adornment are not to disappear from general use, methods must be devised for rearing fur-bearing animals in confinement."

Possibly the principal reason why game farming for the purpose of producing either meat or furs has never been developed into an important industry is

(*Concluded on page 225.*)



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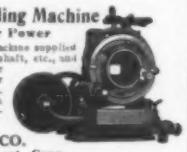
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(*Concluded from page 224.*)

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(*Concluded from page 213.*)

facilitate fighting them. A small surface fire may be stopped entirely by a road or even a path.

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INVESTIGATING THE SLEEPING SICKNESS OF UGANDA.

(*Continued from page 219.*)

top of a flat hill about six miles from the lake, where the climate is temperate and pleasant, but the rainfall heavy. The camp is 750 yards in length by 250 yards broad. The situation is rather isolated, as the native capital Kampala, whence

(*Continued on page 226.*)

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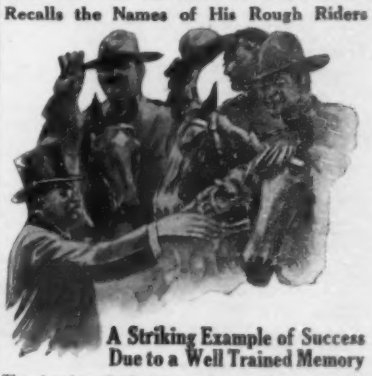

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supplies are obtained, is 27 miles to the west, while the British headquarters are about 23 miles farther on, and the nearest concentration camp is 7 miles distant. This isolation enhances the work of the commission, so that progress is relatively slow. The main laboratory is a building of corrugated iron, 45 feet long by 18 wide. It has accommodation for six workers, and is well equipped with all appliances for elaborate bacteriological and microscopical work. A large fly-proof shed 30 feet square constitutes the monkey house. As the mortality was heavy among the animals through being imprisoned, and in view of their preference for the open air, Sir David Bruce has slowly displaced the monkey shed in favor of separate open-air boxes set up on posts a few feet above the ground, in which the Uganda monkey can live for years in captivity and in perfect health. A third corrugated iron building forms the Director's residence, while there is a large mess-house and a number of other buildings for the various members of the staff built in the style favored by the better class natives, of wattle and daub thatched with grass. Owing to the natural water supply of Mpumu, comprising a mudhole some five feet in diameter and about twelve inches deep, being situated amid natives suffering from ankylostomiasis, the district engineer, Mr. S. Craink, excavated out of the solid ironstone rock a 3,000-gallon cistern, which is fed from the rain water collected on the roof of the Director's house. This is adequate, for the rainfall in Mpumu is heavy, and an inch of rain provides 1,300 gallons for the cistern.

Another ingenious feature is the novel dust destroyer for use in the combustion of rubbish. This was also cut out of the solid rock, and comprises a small chamber five feet square fed through a circular opening in the top, which is level with the ground. The roof and front are formed of thick corrugated iron inclosing a thick layer of clay, and there is a chimney nine feet in height fashioned of corrugated iron sheeting.

As the commission is engaged in the investigation of other fell diseases, which are especially rife among cattle, there are numerous sheds for the housing of animals for the purpose of fatnoming these diseases. There is a malady known as m'kebe, which is especially destructive among calves, the mortality running as high as forty to sixty per cent.

As the study of the tsetse fly is the vital work of the commission, arrangements were completed to secure an adequate supply of the insect. Six boys are retained for this work. But as the Lake is six miles from the camp, and it is not possible for them to make the journey to and fro every day from the latter and also find time for fly-catching, they have been provided with a hut near the lake shore at Kibanga. This area was cleared some time ago, and was authorized to be used as a landing place for communication with the various islands. But when the commission arrived, it was found in a neglected condition and the tsetse fly rampant. The commission had the matter rectified, and a tsetse fly has not been caught at this point for a long time. The boys are provided with a canoe, collecting nets, and bottles, and have to make a trip to a suitable spot to effect their captures. Owing to the swarms that thrive on the lake shores, this has not been a difficult matter; and although at one spot the boys capture from two to three hundred flies every day, there is no apparent diminution in the supply.

The successive commissions that have been dispatched to Uganda have carried out continuous work, and in this way have been enabled to clear up many points concerning the peculiar characteristics of the tsetse fly. Many data have been collected regarding the period which a fly can remain infectious. The determination of this question is of paramount importance, since upon its decision rests the action of

(*Concluded on page 227.*)

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Scientific American Supplement 1574 discusses steel for reinforced concrete.

Scientific American Supplements 1575, 1576, and 1577 contain a paper by Philip L. Wormley, Jr., on cement mortar and concrete, their preparation and use for farm purposes. The paper exhaustively discusses the making of mortar and concrete, depositing of concrete, facing concrete, wood forms, concrete sidewalks, details of construction of reinforced concrete posts.

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(*Concluded from page 226.*)

the authorities. The lake shore and islands have been cleared of natives, and their return is being delayed until science is able to indicate that such could be safely made. Again, it has been stated that the disease can be spread by other biting insects. The commission as a result of its work has found the tsetse fly to be the only carrier, but requests that if the sleeping sickness should be present in any area where this fly is non-existent, full particulars should be communicated to the laboratory. The co-operation of officials, missionaries, and others in various parts of the country is being sought in the effort to stamp out the scourge, and moreover tidings concerning any other epidemical and strange disease are requested for the purpose of investigation. Prof. Koch of Berlin advanced the theory that the disease can be spread by a man returning to his home from a disease-infected area. Though the importance of this is fully realized, the commission maintains that it never occurs, but the possibility is being closely followed. Live monkeys collected from the lake shore are in request, and natives and hunters are asked to dispatch for investigation the heart full of blood from any hippopotamus killed on land or shallow water, since this animal is one of those that are attacked by the fly.

THE HARVARD AVIATION MEET.

(*Concluded from page 217.*)

second, 172 feet 7 inches. Carried a passenger, making a remarkable performance.

Curtiss—Getaway, 121 feet.

Brookins—Altitude, 50 feet or more.

Brookins actually went 105 feet on altitude, but at the official time when the meet closed for the day, 6:30, the contest committee allowed him an altitude of 50 feet. As he was the only contestant for altitude during the day, he was thus first in points. Summary of points for the day:

	Speed.	Altitude.	Duration.	Dist.
Grahame-White ..	0	0	2	2
Curtiss	0	0	0	0
Brookins	0	3	0	0
Johnstone	0	0	1	1
Willard	3	0	0	0

A summary of points for the six days of flying which ended with a brief attempt at altitude by Brookins in high wind is as follows:

	Speed.	Altitude.	Duration.	Distance.	(Bomb) Trials.	Score.
Grahame-White ..	12	5	7	6½	28	75
Curtiss	6	0	0	½	17	25
Willard	7	0	0	0	13	13
Brookins	0	7	2	1	0	0
Johnstone	0	2	8	7	0	0

Relative standing of aviators, including September 9th:

	Speed.	Altitude.	Duration.	Distance.	(Bomb) Average.	Total.
Grahame-White.	12	5	7	6½	2.7	33 1-5
Johnstone	0	2	8	7	0.0	17
Brookins	0	7	2	1	0.0	10
Curtiss	6	0	0	½	1.5	8
Willard	7	0	0	0	1.0	8

Best Records to Date—Speed, Grahame-White, 3 laps, 5¼ miles, 6 minutes 1 second; altitude, Brookins, 3,860 feet; duration, Johnstone 107 minutes 24 2-5 seconds; distance Grahame-White 45 miles 617 feet; slow lap 5¼ miles, Brookins, 13 minutes 48 seconds; getaway, Grahame-White, 26 feet 11 inches; accuracy, Grahame-White, 33 feet 4 inches; bomb throwing, Grahame-White, 10 bombs, score, 37; Globe course, Grahame-White, 33 miles, 40 minutes 1 3-5 seconds.

Of the above records Grahame-White holds six, Brookins two and Johnstone one.

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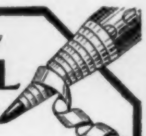

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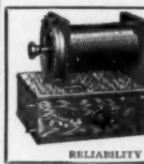

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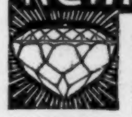

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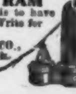

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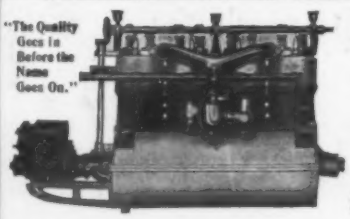

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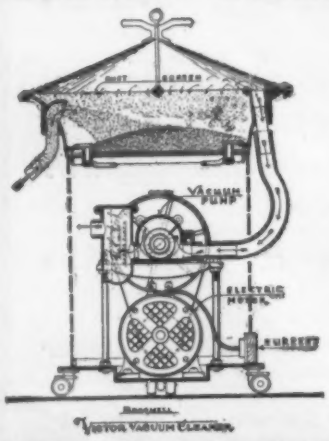

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